ARI Research Note 87-12

COMPARISON OF NATIONAL TRAINING CENTER DATA SOURCES

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This research note has a twofold purpose: to provide an introduction to the National Training Center's (NTC's) Range Data Management Subsystem log data, and to compare the two NTC digital data sources, 1) Core Instrumentation Subsystem log tapes and 2) RDMS log tapes.

Section One describes the data sources and the types of data that may be expected from each, Section Two documents the methodology used in the mission segments selected, Section Three presents the results of the analysis, and Section Four presents the conclusions.

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COMPARISON OF NATIONAL TRAINING CENTER DATA SOURCES

CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

The purpose of this report is twofold. It provides an introduction to the Range Data Measurement System (RDMS) log data from the National Training Center (NTC) and it provides a comparison of the two NTC digital data sources, Core Instrumentation Subsystem (CIS) log tapes and RDMS log tapes.

The report is divided into four sections. Section 1 describes the data sources and the types of data that may be expected from each. Section 2 documents methodology used in comparing the two sources, including identification of specific mission segments selected. Section 3 presents the results of the analysis, both at the micro level, for the selected mission segments, and at the macro level, with some collective statistics. Finally, section 4 is the conclusion.

I. NTC INSTRUMENTED DATA

The NTC Instrumentation System (NTC-IS) supports the collection and retention of data at the National Training Center. The NTC-IS consists of four major subsystems, all of which are involved to some extent in the collection of digital data:

(1) The Range Data Measurement System (RDMS),
(2) The Core Instrumentation Subsystem (CIS),
(3) The Live Fire Subsystem (LFS), and
(4) The Range Monitoring and Communications Subsystem (RMCS)

The RDMS and CIS are the subsystems principally involved in digital data collection at the NTC. Figure I-1 shows the interrelationships of the relevant components of the RDMS and CIS relating to data collection.

Data collected at the NTC can be divided into three general categories: raw field data, data input manually, and data derived from either or both of the prior two categories.

Raw field data are collected by the RDMS; input data are entered via components of the CIS, and data elements are derived by both subsystems.

I.1. Data Collected/ Logged by the RDMS

The RDMS collects "real time" data, meaning that each RDMS data element is retrieved as soon after it happens as possible, constrained only by the limits of the instrumentation systems.

Raw field data events collected by the RDMS include trigger pull (fire event) with associated ammunition remaining messages, laser illumination (pairing), and microphone key pressed/ released. In addition to the event data, the RDMS collects raw ranging data from which position/ location is derived for each instrumented player.

The RDMS provides one source of archival data from the NTC. Data elements logged from the Position/ Tracking Computational Component (PTCC) of the RDMS are listed in Figure I-2.

RDMS data are as accurate as the reliability of the collecting/ transmitting hardware allows. The complexity of NTC field instrumentation is conducive to a wide variety of error-producing conditions, including:

(1) Spurious RF transmissions, leading to erroneous events,
(2) "Noisy" laser sensors which generate spurious and/or inaccurate pairing events;
(3) Hardware/electronic player instrumentation problems leading to loss or duplication of valid events, and the generation of invalid events; and

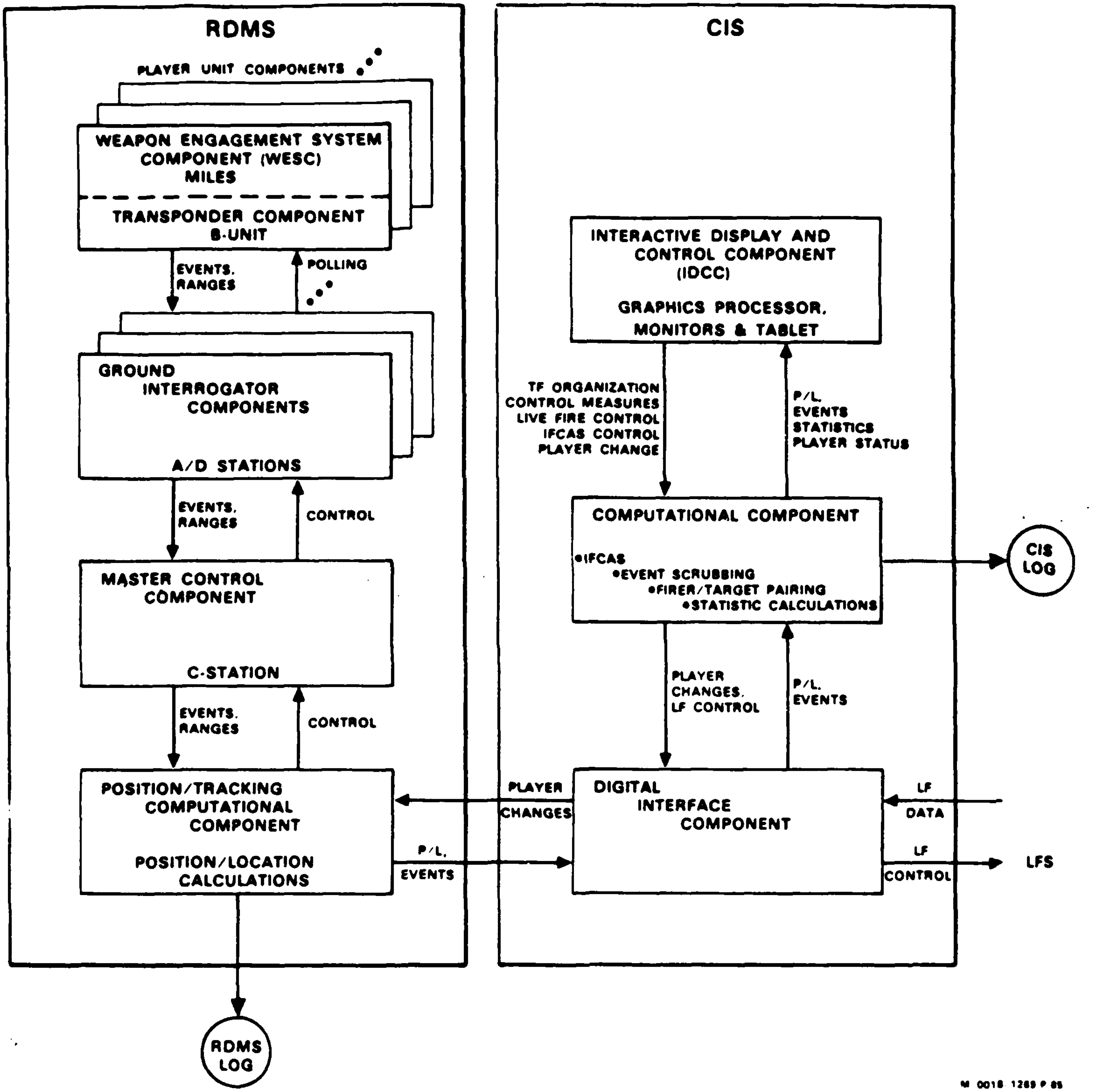

Figure I-1 NTCIS Subsystems

DATA ELEMENT	DESCRIPTION
Trigger Pull	Event received when a shot is fired by an instrumented weapon system. Event data consist of firer player number and weapon type.
Ammunition Remaining	Pair of events received immediately following trigger pull. Tens digit in former message, units in latter.
Laser Illumination	Event sent by target (player being lased.) This event type is one of three different kinds of codes, for HIT, NEAR MISS, and KILL. For a HIT message, event indicates general type of weapon. For NEAR MISS and KILL, more exact weapon type information is included.
Communication	An event is sent by a player whenever the microphone key for either net is depressed or released. The message includes the net (1 or 2) and the action (depress = on, release = off).
Live Fire	There are four Live Fire events passed from the targets via RDMS. They are: target UP, target DOWN, HIT by ballistic projectile, and HIT by Laser.
Position/Location	The Position/Location of each instrumented player is derived by RDMS software from raw Range Data and logged.
Player Status	Player Status initialization and updates, which are entered from the CIS and transmitted to the RDMS are also logged. These data include the B-Unit Player identification/weapon system assignment.

Figure I-2 Data Elements Logged by the RDMS

(4) Coverage problems resulting in the loss of track of instrumented vehicles and the corresponding loss of position/ location and event retrieval capability.

Even in the case of perfect hardware performance, it is possible for errors to be introduced by faulty initialization. If the proper B-unit code is not associated with the right player identification, incoming events will be improperly assigned or may be deleted as invalid. Such problems can quickly lead to a serious loss of data integrity.

I.1.1 RDMS Log Data Processing

Processing of the RDMS log tapes is accomplished by using the ARI-POM developed program GDETAP, which reads RDMS log tapes and creates three different reports:

(1) Event lists, including firing and pairing data,
(2) Commo report including the duration in seconds of each radio transmission, and
(3) Player report, which shows the correspondence between RDMS player numbers and B-units.

Various VAX utilities can be used to reprocess the basic report files to yield a variety of files and reports. A complete description of program GDETAP is contained in the document Program GDETAP Documentation, (Briscoe, 1985).

I.2 Data Collected/ Logged by the CIS

The Core Instrumentation Subsystem (CIS) is the heart of NTC instrumented operations, serving as the interface between the trainers and the field operations.

The CIS performs several functions related to the collection/ generation of NTC digital data:

(1) The Interactive Display and Control Component (IDCC) provides the interface between Exercise Monitoring and Control (EMC) and Training Analysis and Feedback (TAF) personnel and the ongoing exercise(s).

(2) The CIS/IDCC also supports pre-exercise initialization which includes entry of:

(a) Player initialization information,
(b) Control measure information,
(c) Task Force organization,
(d) Live Fire scenarios, and
(e) Pre-planned artillery.

(3) The IDCC provides real-time control of the Live Fire Exercises (LFX) by the Live Fire Control Officer (LFCO).

(4) The CIS Computational Component is used to pair firers with targets for real-time engagement simulation.

(5) The CIS provides computing capacity for real-time data manipulation, such as the calculation of statistical measures and unit roll-up totals.

(6) The CIS logs data in real-time to provide the primary archival source of NTC data.

Figure I-3 lists NTC data logged by the CIS, noting data elements that are logged by both the RDMS and the CIS. Many of the elements logged from the CIS are manually input data elements. Reliability of manual data depends upon the accuracy of the personnel entering the data and the verification procedures that are employed, such as proofreading and consistency checks.

I.2.1 CIS Log Data Processing: The NTC Database Research System

The NTC Database Research System (NTCDRS) was developed for ARI/POM to facilitate analysis of NTC data. The heart of the system is the INGRES relational database system, which allows the researcher freedom in the ways he can formulate queries and generate reports. The NTC Database Research System, then, is the means by which NTC CIS log data for one mission are converted into the INGRES data base format. The system consists of two major steps, TRANSLATE and LOAD. Figure I-4 shows the processing flow of the NTCDRS.

The TRANSLATOR converts the binary formatted NTC data from one mission segment into a man-readable ASCII (text) file. The output from the TRANSLATOR consists of three files, a LOG file summarizing the operations performed by the program, a HOLD file, which lists the message types not processed by the program, and the ASCII DATA file. The ASCII file can be read, edited, or processed by VAX system utilities, and serves as the input file for the LOAD process.

The LOAD consists of two separate FORTRAN programs, LOADER and DBCOPY. The LOADER program converts the DATA file created by the TRANSLATOR into a series of 63 files, each of which relates directly to one or more INGRES tables. Each file is an ASCII file that can be printed, edited, or processed by other programs. The DBCOPY program reads the 63 files into 61 INGRES tables. Figure I-5 shows the relationship between the files output by LOADER and the INGRES tables created by DBCOPY.

The result of NTCDRS processing is an INGRES database for each mission segment processed.

DATA ELEMENT	DESCRIPTION
Background/Documentation	History and segment name, start and end times, mission type, exercise conditions, task force and OPFOR organizations.
Unit/Player Status info	Status of individual players and/or units, including: Instrumented/Not Instrumented Tracked/Not Tracked Position/Location
Fire Event (RDMS trigger pull)	Event generated when a shot is fired by an instrumented weapon system. Should be identical with RDMS log, with the exception of the deletion of invalid events
Pairing (RDMS pairing except as noted)	Event (HIT, NEAR MISS, or KILL) generated when the laser sensors of an Instrumented Target System are illuminated and decoded into a valid message. If possible, target is paired with a firer. If unpaired, firing weapon type is discarded.
Control Measures	Locations for control measures entered from IDCC. Message can include control measures added or deleted. Mines are included in this category.
Indirect Fire Casualty Assessment (IFCAS)	Fire Mission Number, assessment of number of casualties inflicted.
Call Fire Missions	Call for previously planned Indirect Fire (artillery, mortars).
Commo	Player Identification, Radio Net, and duration of Commo messages longer than 55 seconds, should agree with RDMS log for those messages, but all others are lost.

* Manually Entered

Figure I-3 Data Elements Logged by the CIS

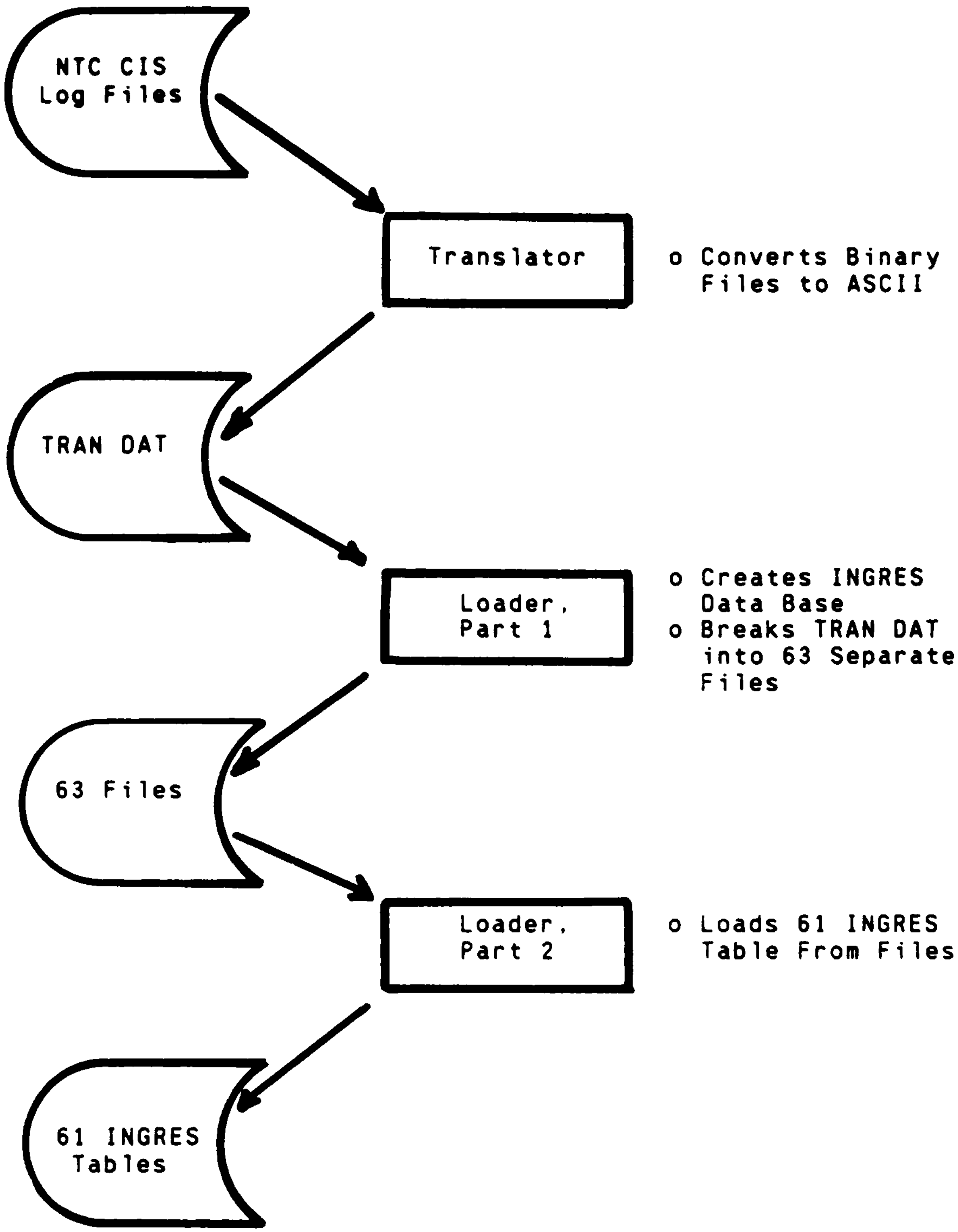

Figure I-4 NTCDRS Processing Flow

INGRES table name vs. LOADER file name table

Table Name	File Name	Order
SEGMENTDATA	SEGDAT.HLD	1
SEGHEADER	SEGHEA.HLD	2
MISSIONS	MISSIO.HLD	3
SEGSUMRATING	SEGSUM.HLD	4
PLSTATVECTOR	PLSTAT.HLD	5
PLSTATVECTOR	PLYRAD.HLD	6
PLYREDIT	PLYRED.HLD	7
PLYRCHANGE	PLYRCH.HLD	8
PLYRINSTSTAT	PLYRIN.HLD	9
PLYRREDESIG	PLYRRE.HLD	10
PLYRLOC	PLYRLO.HLD	11
UNITSTATEVT	UNITST.HLD	12
UNITEDIT	UNITED.HLD	13
UNITREDESIG	UNITRE.HLD	14
UNITLOC	UNITLO.HLD	15
MIXEDUNIT	MXUNIT.HLD	16
UNITENGMSG	UNITMG.HLD	17
UNITENGAGE	UNITEN.HLD	18
IFCASTARGET	IFCAST.HLD	19
IFCASCASULTY	IFCASC.HLD	20
FIRESUPLOG	FIRESU.HLD	21
CASUALTIES	CASULT.HLD	22
IFCASALERT	IFCASA.HLD	23
IFPREPLANTAR	IFPREP.HLD	24
IFTARGROUP	IFTARG.HLD	25
CONMESVECTOR	CMVECT.HLD	26
CMDELETE	CMDELT.HLD	27
CMLOCATION	CMLOCA.HLD	28
CONMESTACCAT	CMTACT.HLD	29
FIRING	FIRING.HLD	30
PAIRING	PAIRIN.HLD	31
COMMO	COMMOM.HLD	32
EQUIPSTATUS	EQPSTA.HLD	33
CPUSTATUS	CPUSTA.HLD	34
UNVEHSTATUS	UNVSTA.HLD	35
TRACKINGSTAT	TRASTA.HLD	36
LFSCENARIO	LFSCEN.HLD	37
LFTARGETEVNT	LFTAEV.HLD	38
LFTARGETSTAT	LFTAST.HLD	39
TOTHOLVECTOR	TOTHLV.HLD	40
PERCASLTYSUM	PERCAS.HLD	41
PERCASLTYSUM	CASLOG.HLD	42
MINFLDCASLOG	MNCASL.HLD	43
MINEFIELDCAS	MNCAST.HLD	44
UNITMOVEMENT	UNMOVE.HLD	45
UNITTRANS	UNTRAN.HLD	46
ENGRNGSUM	ENGRNG.HLD	47
FIRPAIRING	FIRPAR.HLD	48
VPRDRENGAG	VPRDRG.HLD	49
OTHERWEAPON	OTHWEA.HLD	50
FREEFORMMSG	FREMSG.HLD	51
MSGCATEGORY	MSGCAT.HLD	52
OCASSESSMENT	OCASMT.HLD	53
OCINFOELEMNT	OCELMT.HLD	54
AARCOMMANDS	AARCOM.HLD	55
MAPBUTTONS	MAPBUT.HLD	56
BLFORBUTTONS	BLFORB.HLD	57
ALERTBUTTONS	ALERTB.HLD	58
OPFORBUTTONS	OPFORB.HLD	59
RANGEFANS	RNGFAN.HLD	60
LFBUTTONS	LFBUTT.HLD	61
OTHERBUTTONS	OTHBUT.HLD	62
COORDINATES	COORDS.HLD	63

Figure I-5 INGRES Tables vs. Loader File Names

II. STUDY METHODOLOGY

This chapter is divided into two parts. The first part discusses the data chosen for analysis and the second part documents the methodology used to compare the two data sources.

II.1 NTC Data

The data which form the basis of this report were from a rotation during FY 85. Figure II-1 shows the times and dates for all missions executed during the rotation. Dates are coded to preclude identification of a specific unit.

II.1.1 Selection of Data for Detailed Analysis

Three mission segments were selected for detailed comparison. The criteria for selection were as follows:

1) Selected segments should be event-rich, in order to provide as many chances for agreement/ disagreement as possible.

2) In order to facilitate processing of RDMS data, segments should be selected which are not running concurrently with the other task force. If concurrent exercises are selected, it is difficult to assign field events to the proper task force.

3) Selected segments should be somewhat separated in time, to enable assessment of improvement or degradation in data quality over time.

4) Both task forces should be examined.

The three mission segments selected were: (1) Mechanized Mission Segment 08, Day 4, (2) Armored Mission Segment 12, Day 7, and (3) Mechanized Mission Segment 19, Day 13. For reasons of expediency, the three segments will be referred to as M008, A012, and M019, respectively, within the text.

While the time distribution was not optimal because of the paucity of events in the early mission segments, the other criteria were fairly well satisfied.

The detailed comparisons focus on two kinds of data that occur abundantly in both sources:

1) Firing Data are initiated by MILES trigger pull events received via the RDMS. These events are logged by the RDMS and transmitted to the CIS, where they are also logged. The NTCDRS creates a FIRING table which can be compared directly with RDMS data.

2) Pairing Data are initiated by MILES sensor illumination events (HIT, NEAR MISS, KILL) received via the RDMS. They are logged by the RDMS and transmitted to the CIS. CIS software attempts to correlate each pairing event with a valid fire event that occurred within a reasonable time of the pairing. Both correlated and uncorrelated pairing events are written to the CIS log. The NTCDRS creates a PAIRING table with all pairing events initiated by combat fire events, including the firer ID if known. Controller gun kills present in the RDMS data should be present in the NTCDRS PLYRCHANGE table.

Armored Task Force

Segment	Title	Start Date & Time	Duration
1	Nightmov	Day 1, 23:50:24	02:53:58
2	MTC	Day 2, 02:52:30	08:48:47
3	RECON	Day 2, 22:38:08	03:20:07
4	D ATK	Day 3, 02:05:16	09:32:51
5	RECON	Day 3, 17:14:30	06:01:44
6	N ATK	Day 3, 23:45:28	09:01:36
7	RECON	Day 4, 19:14:21	05:53:41
8	D ATK	Day 5, 02:00:03	10:46:11
9	DEF IN S	Day 5, 20:55:14	00:16:17
10	LRP	Day 5, 23:55:16	01:22:57
11	RECON	Day 6, 21:22:31	03:49:08
12	DEF IN S	Day 7, 01:20:04	08:18:25
13	GRAPHIC	Day 7, 19:04:41	05:53:04
14	MTC HATK	Day 8, 02:35:12	08:32:22
15	RECON	Day 8, 23:03:33	03:22:10
16	MINI SCT	Day 9, 06:02:43	06:57:53
17	TEST	Day 9, 13:04:53	00:00:00
18	TEST	Day 9, 13:04:53	00:23:47
19	TEST2	Day 9, 13:34:07	03:09:47
20	RECON	Day 9, 22:42:20	12:27:56
21	TASK ORG	Day 11, 07:37:29	00:37:37
22	TEST3	Day 11, 10:14:52	01:05:33

Mechanized Task Force

Segment	Title	Start Date & Time	Duration
1	LFTEST	Day 1, 21:51:33	00:05:27
2	NIGHTMOVN	Day 1, 23:52:25	06:34:31
3	MTC	Day 2, 06:26:55	04:39:46
4	LF VIP B	Day 2, 13:47:29	00:45:34
5	PROBE	Day 2, 20:45:08	06:14:16
6	RECON	Day 3, 22:07:39	00:54:03
7	RECON2	Day 3, 23:57:23	03:09:12
8	DEF BP	Day 4, 03:06:32	05:49:10
9	D ATK	Day 5, 03:36:49	07:23:45
10	DEF BP	Day 7, 19:56:42	12:00:20
11	DEF BP	Day 8, 08:41:06	00:38:35
12	LFX DEF	Day 8, 09:19:42	04:13:04
13	DEF BP N	Day 9, 01:55:05	00:35:27
14	LFX NITE	Day 9, 02:30:23	03:05:06
15	CATK LFX	Day 9, 07:55:17	09:20:44
16	AAR PREP	Day 10, 05:01:32	09:06:08
17	NIGHT AT	Day 11, 00:08:26	06:55:30
18	LRRP	Day 12, 00:05:58	04:15:58
19	DEF IN S	Day 12, 21:17:32	12:00:33
20	D ATK	Day 14, 03:27:21	07:14:19
21	RECON	Day 14, 19:33:14	00:34:02
22	RECON	Day 14, 21:45:36	04:45:18
23	D ATK	Day 15, 03:41:02	04:56:29

Figure II-1 Selected Rotation Mission Segments

Due to the time required for the FIRING and PAIRING data comparisons, short, event-rich periods within each of the selected segments were chosen for detailed comparison.

II.1.2 Description of CIS Log (NTCDRS) Source Data

The NTCDRS data used in this study were extracted from tables in the INGRES data bases containing data for the mission segments selected for analysis. The tables used from these databases included the FIRING, PAIRING, and PLYRCHANGE tables. These tables are described below:

FIRING - This table includes stream data messages which are created based upon weapon firing information received from the RDMS system. The firing information is used by the NTC software for pairing firings with effects, as described below in the definition of the Pairing table. In addition, firing messages are utilized in the NTC software to generate firing alerts. Since the firing data are tied to the instrumentation system, only those weapons equipped with the MILES system and possessing B-units can generate a firing message.

PAIRING - This table defines how weapon firing events were paired with weapon effects events. This pairing information is used in the NTC software in the computation of ground player performance statistics and alert messages. Weapon target pairing is performed using time coincidence and the firer's weapon type code as determined from the LASER code recieved by the target. In cases where the firer's weapon type code in the firing message does not uniquely identify the weapon type which fired, the player's ID is used to obtain a predetermined weapon type associated with the particular player.

PLYRCHANGE - This table includes all stream data messages which define the Player Status.

The FIRING table was compared directly with firing data read from the RDMS log tape; the PAIRING and PLYRCHANGE tables were used in trying to match RDMS log pairing data.

II.1.3 Description of RDMS Log Source Data

The RDMS log data for the rotation are contained on 21 magnetic tapes. The exact time period covered by these tapes begins at 21:39 on Day 1, and ends at 09:21 on Day 15. In general the data are continuous with two exceptions, a gap of over sixteen hours between tapes two and three, and a gap of over four hours between tapes five and six. Otherwise, the time between tapes, during which data were not recorded by the RDMS, ranges from two seconds to almost fifteen minutes. Figure II-2 is a

graphic depiction of the time period for which data were recorded on each tape in the series, and the table below lists the time period covered by each tape.

Tape	Started at . .	Ended at . . .	Between
1	Day 1 21:39:08	Day 2 12:17:23	N/A
2	Day 2 12:20:46	Day 2 17:03:46	3:23
3	Day 3 09:15:57	Day 4 03:36:11	16:12:11
4	Day 4 03:36:37	Day 4 13:37:07	0:26
5	Day 4 13:49:12	Day 5 10:13:51	12:05
6	Day 5 14:26:54	Day 7 02:22:43	4:13:03
7	Day 7 02:23:37	Day 7 09:15:05	0:54
8	Day 7 09:19:39	Day 8 05:42:07	4:34
9	Day 9 05:43:10	Day 8 11:04:44	1:03
10	Day 9 11:07:20	Day 8 14:29:38	2:36
11	Day 9 14:32:25	Day 9 11:46:12	2:47
12	Day 9 11:52:07	Day 10 06:51:18	5:55
13	Day 10 06:52:39	Day 10 15:00:33	1:21
14	Day 10 15:01:53	Day 11 12:46:44	1:20
15	Day 11 12:48:52	Day 12 07:54:36	2:08
16	Day 12 08:00:47	Day 13 04:05:08	6:11
17	Day 13 04:05:04	Day 13 08:45:15	0:04
18	Day 13 08:52:12	Day 14 03:59:13	6:57
19	Day 14 04:04:48	Day 14 12:49:34	5:35
20	Day 14 13:04:20	Day 15 07:33:53	14:46
21	Day 15 07:33:51	Day 15 09:20:49	0:02

RDMS data are logged without reference to specific missions, so tables in the NTCDRS, which are mission- based, can be correlated with RDMS data only by using time of day. Furthermore, NTCDRS data are task force specific, while RDMS data are not, so in the case of concurrent exercises (both task forces running engagement simulation exercises simultaneously), RDMS data contain events from both task forces.

II.2 Methodology

The basic methodology employed in this study was the comparison of listings from the two sources (RDMS log and NTCDRS) to isolate the elements which compared and did not compare. For those elements which were not comparable, an effort was made to explain the differences. The major thrust of this effort was to assess the fidelity with which RDMS data were received, processed, and stored by the CIS. Accordingly, the emphasis in explaining differences was directed toward RDMS data, and in tracking down the reasons those data did not appear in the NTCDRS tables. Less effort was directed the other way, in determining why data that appear in the NTCDRS tables are not on the RDMS log tapes. Various tools were used to assist in this effort, including system editors, the VAX sort routine, and a number of FORTRAN programs.

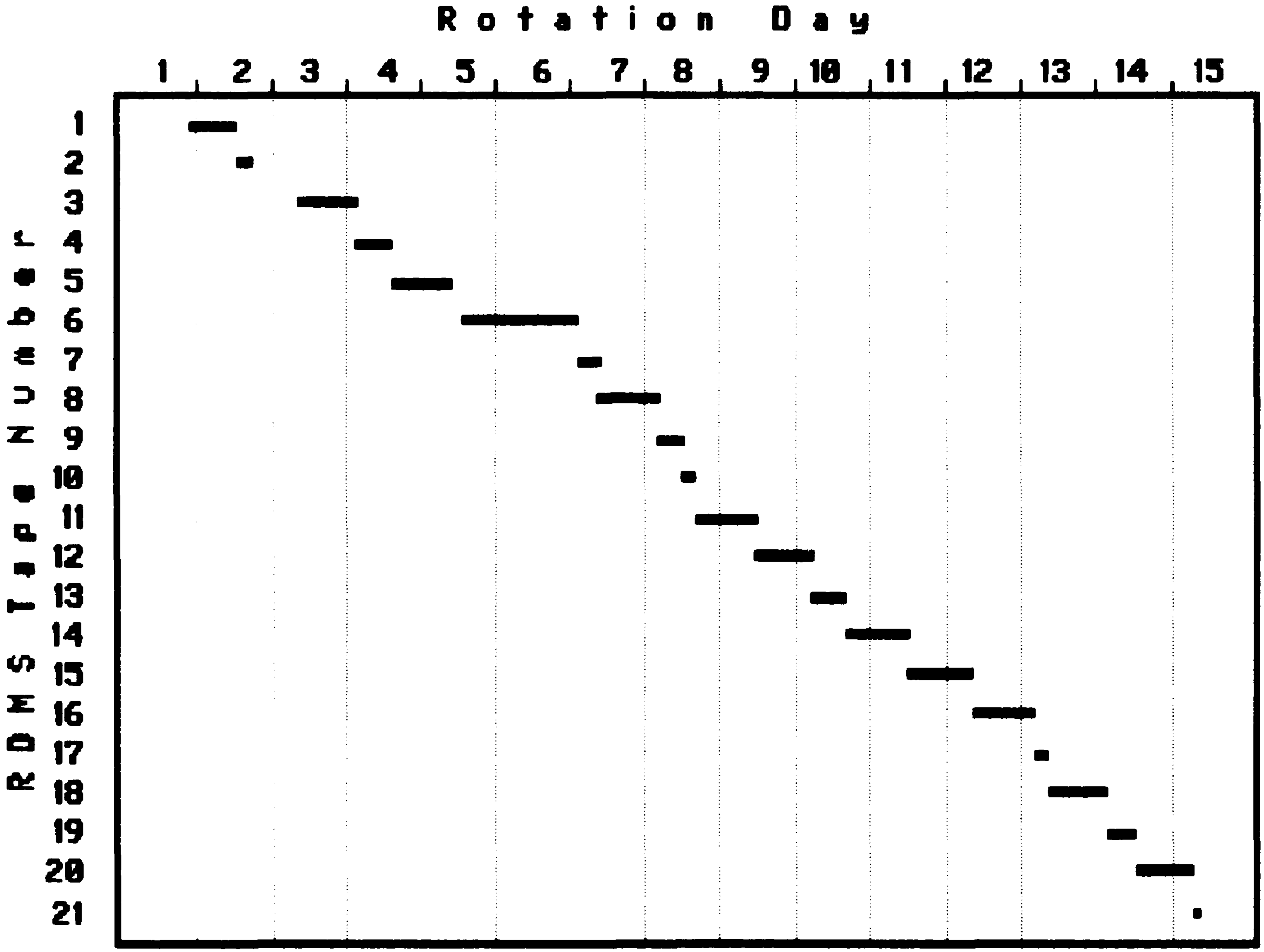

Figure II-2 Sample Rotation RDMS Tape Coverage

II.2.1 Generation of RDMS files

Basic files that contained RDMS data were generated by executing program GDETAP for each of the 21 RDMS tapes containing data for the rotation. Figure II-3 diagrams the processing which resulted in RDMS files that were directly comparable with NTCDRS tables. In order to minimize tape reading operations, each tape was read only once, and the maximum amount of data was recovered. The generated files were then split into two specific types, Firing and Pairing, to facilitate comparisons with NTCDRS data. Then, because the RDMS tape periods do not correspond to the time periods covered by the selected mission segments, the files were recombined so that they covered the exact time periods of the target mission segments. At this point time-ordered RDMS files were available which had analogous tables within the NTCDRS.

II.2.2 Generation of NTCDRS Files

CIS log files which were utilized in this study were listings of tables generated by the NTCDRS process, which was briefly described in Chapter 1.

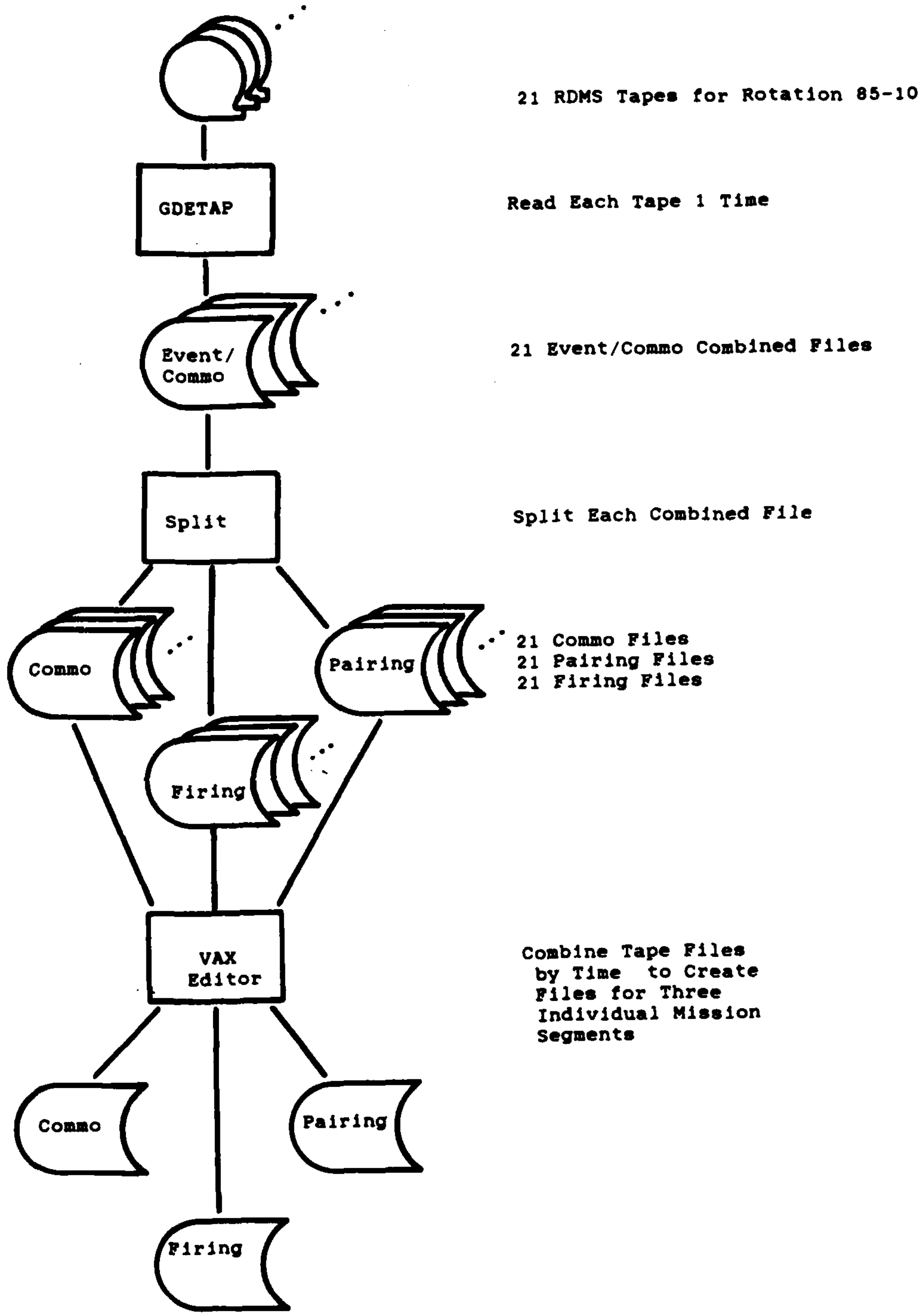

Figure II-3 RDMS Log Processing Flow

III. RESULTS

This section presents the results of the analyses. It is divided into two parts. The first part presents the results of an investigation into overall error rates, and deals with the entire set of RDMS data. The subsequent section documents the results of more detailed analyses of the three specific mission segments, and include four reports:

1) Comparison of fire events,
2) Comparison of pairings,
3) "Killers" demonstration for the three segments, and
4) Delay time analysis for the three segments.

III.1 Invalid Messages

The initial study undertaken on the RDMS log data was on the number of invalid events contained in the data. Event codes are bit patterns received by the RDMS, but not all patterns represent legitimate events at the NTC/RDMS, and were classed as invalid events. No investigation was made into a second class of invalid events, those which were supported by the RDMS , but not for the player which generated the event. The results indicated an overall error rate of less than one percent, with individual tapes ranging from 0.29 percent up to 1.2 percent. Furthermore, the error rates do not appear to differ significantly from the beginning of the rotation to the end. The table below presents a list of the error counts and percentages for each RDMS tape and in total.

RDMS Tape	Total Events	Invalid Events	PCT.
1	42668	325	0.76
2	8347	72	0.86
3	39474	369	0.93
4	23749	227	0.96
5	25042	232	0.93
6	17459	191	1.09
7	31403	253	0.81
8	19093	229	1.20
9	13820	93	0.67
10	2900	28	0.97
11	22204	169	0.76
12	49138	426	0.87
13	9691	90	0.93
14	21544	174	0.81
15	13234	118	0.89
16	25688	236	0.92
17	19311	134	0.69
18	29104	288	0.99
19	18982	117	0.62
20	21093	112	0.53
21	2065	6	0.29
Total	456009	3889	0.85

Figure III-1 - Invalid Messages

III.2 Analyses of Specific Mission Segment Data

The following analyses were based on more detailed studies of three mission segments, Mechanized Task Force segments 8 and 19 and Armored Task Force segment 12. Specific terms which are used in the text and tables require definition; they are defined below:

LPN - Logical Player Number. This is an index that is used within the RDMS data to refer to a specific player or vehicle. It is an integer between 1 and 500 and may be assumed to be assigned to a specific RDMS transponder (B-unit). Conversely, each B-unit is assigned one and only one LPN.

PID - Player Identification. This refers to the name by which each player or vehicle is identified within the CIS log. The PID is a 3-character alphanumeric name. The term "bumper number" is used interchangeably. Ideally, each LPN should refer to one and only one PID, and PIDs should be unique. Neither condition is true. Occasionally, the PID for a BLUEFOR player will be the same as an OPFOR PID. Also, two PIDs will "share" an LPN upon occasion.

Delay Time - This term refers to the period of time between the occurrence of an RDMS event and the receipt of the event at the C-station, or RDMS master control station. The delay time is passed to the C-station as part of an event message. In general, if RDMS coverage is adequate, the delay time will be less that or equal to the time between pollings, which is assumed to be 5 seconds at the NTC. When the vehicle is not in constant range or line of sight of the relay/ repeater stations (A-stations), however, the delay is increased significantly.

Pairing - For the purposes of this document, the term pairing refers to an RDMS sensor-illumination event. When a sensor is illuminated by a MILES laser, two pieces of information can be decoded, the intensity, yielding the result (HIT, NEAR MISS, or KILL), and some form of identification. The level of identification depends on the result; for a NEAR MISS only the general category (heavy or light weapon) can usually be determined, but for a HIT or KILL outcome the firer can be identified by weapon type code. A matched pairing is achieved when the firer can also be determined by matching event times. Most pairings are unmatched for any of several reasons:

(1) Uninstrumented Firer (MILES but no B-unit)

(2) Firer or target "hidden" from RDMS relay/repeater stations, precluding event transmission during "window" allowed for matching events, or

(3) Base time discrepancy between CIS and RDMS, preventing time correlation.

III.2.1 Firing Event Analysis

Firing data were examined for active periods of each of the three target mission segments. The periods were 0500-0600 for Armored segment 12 and Mechanized segment 19, and 0500-0530 for Mechanized segment 8. The process used was to attempt to match each fire event in the RDMS data with a corresponding entry in the NTCDRS FIRING table. Two rules were followed regarding the selection of RDMS data included in the statistics. First, RDMS events with delays of greater than 25 seconds were excluded in an attempt to replicate the action of CIS realtime software. Second, for OPFOR BMP vehicles, the RDMS indicates a number of machine gun firings, while they are conspicuously absent from the NTCDRS FIRING table. The number of RDMS BMP machine gun fire events is shown, but not included in the comparison statistics. Table III-1 presents the results of this effort.

The table shows, for each mission segment and vehicle type, the number of fire events logged by the RDMS, the number of entries in the NTCDRS Firing table, and the number of events for which the two sources agree. When agreement is less than perfect, the percentage of RDMS events that agree with NTCDRS table entries is shown in parentheses.

Two conclusions may be drawn:

(1) The two sources agree very well. One segment shows perfect agreement, while the other two are very close, at 98 and 99 percent. The overall agreement, totalling fire events for all three segments, is 99 percent.

(2) There appears to be a problem with the NTCDRS regarding BMP machine gun firings. While machine gun firings are not a significant killer on the battlefield, they are good indicators of general battlefield activity. In addition, they are captured by the NTCDRS for both BLUFOR and OPFOR tanks.

Table III-1 Firing Data Tabulation -- Firing Data Comparison

	Mechanized Segment 8 0500-0530 RDMS	CIS	Agree(%)	Armored Segment 12 0500-0600 RDMS	CIS	Agree(%)	Mechanized Segment 19 0500-0600 RDMS	CIS	Agree(%)
BLUEFOR									
Tanks	37	37	37(100)	307	307	305(99)	92	92	92(100)
APCs	6	6	6	12	12	12	2	2	2
OPFOR									
Tanks	45	45	45(100)	284	284	281(99)	302	297	295(98)
BMPs	39	39	39	118	118	118	33	33	33
	(11)			(0)			(33)		
• ZSUs	3	3	3						
Totals	130	130	130	719	719	714(99)	329	324	322(98)

(1) Tank firings include main gun firing only
(2) BMP firings include both 73mm and SAGGAR, with machine gun firings shown below in parentheses

III.2.2 Pairing Events Comparison

Pairing data were examined for active periods of each of the three mission segments. The periods were 0500-0530 for both Mechanized segment 8 and Armor segment 12, and 0500-0600 for Mechanized segment 19.

The analysis of pairing events was slightly more complicated than the firing event analysis because the RDMS pairing data potentially appear in two different NTCRDS tables, the PAIRING table and the PLYRCHANGE table. An additional factor is introduced by the fact that Training Analysis and Feedback (TAF) personnel can enter information on their workstations which ends up in one or both of the NTCRDS tables, but is not in the RDMS log data.

It is important to keep in mind the definition of the term "pairing" as used in this analysis: an RDMS HIT, NEAR MISS, or KILL event caused by laser illumination of MILES sensors. Table III-2 contains the summary statistics for the pairing study. The table is arranged to show the total number of pairings from both the RDMS log and the NTCDRS. The NTCDRS column contains the number of entries in the PAIRING table except for controller gun kills, which are in the PLYRCHANGE table. The RDMS log events which are properly discarded by the CIS are enumerated, and the total number of events which agree is shown.

There are three primary reasons that RDMS events are properly discarded by the CIS software:

(1) Sometimes the electronic instrumentation on a vehicle malfunctions and "floods" the RDMS with event messages. These can either be the repeat of a valid message or the generation of bogus messages. CIS software can be instructed to ignore players which generate events incessantly. For example, in Armored segment 12, 55 events from one player were discarded from both the RDMS and the CIS data.

(2) If the message is delayed more than 25 seconds from occurrence to receipt at the C-station the CIS software ignores it. This is necessary to enable the real time software to maintain efficiency, particularly in matching fire events with pairing events.

(3) When a HIT or NEAR MISS event is received at the same time as a KILL for the same player, it is discarded.

In addition, controller gun kills are retained by the NTCDRS and put in the PLYRCHANGE table rather than the PAIRING table.

Table III-2 Pairing Data Tabulation

	Mechanized Segment 8 (0500-0530)		Armored Segment 12 (0500-0530)		Mechanized Segment 19 (0500-0600)	
	RDMS	NTCRDS	RDMS	NTCRDS	RDMS	NTCRDS
Total Pairings	96	94	148	147	195	175
Noisy Sensors	--	--	55	55	--	--
Excessive Delay	10	--	3	--	8	--
Duplicate HIT/ NEAR MISS	2	--	6	--	3	--
Controller Gun Kills	3	(3)	4	(4)	7	(5)
Potential Pairing Matches	81	94	80	92	177	175
Matches	80		80		150	
Unexplained	1	14	0	12	27	25

Note: The numbers in parentheses represent the number of controller gun entries in the PLYRCHANGE table that match RDMS log events.

As can be seen in Table III-2 two of the segments show that virtually all RDMS pairings appear in the CIS pairing table (80/81 for M008 and 80/80 for A012). However, each of those segments also contained a significant number of NTCDRS pairing table entries which could not be traced back to the RDMS log. As mentioned above, it is possible for TAF personnel to make entries via their graphics tables which influence the pairing table. This may be the primary reason for the remaining mismatches, although no records are maintained at the TAF to verify it.

The third segment M019 had a large number of mismatches for both sources. Over 15% of the RDMS pairings could not be traced to the CIS pairing table. Closer scrutiny showed that the 27 mismatches were contributed by six players. Of the six, only one also had pairings from the two sources that matched. A possible explanation is that the players were loaded properly for the RDMS system to poll them and retrieve events, but were either not loaded into the CIS, or were improperly loaded. The one player which also had valid messages had them after the invalid messages, so he may have been activated later in the segment.

III.2.3 "Killers" Demonstration

Figures III-2 and III-3 graph kills by weapon type, and are intended as a demonstration of an additional potential use of the RDMS data that cannot be supported by CIS data. The figure was generated directly from RDMS KILL event data for the entire time periods of the three mission segments examined earlier. Duplicate kills, (the same player killed more than once) were deleted. The data as presented may prove useful for drawing some general trends, but one point should be raised concerning the reliability of the data:

MILES weapon codes which do not absolutely indicate force (BLUEFOR or OPFOR) were not included in the graphs because such kills cannot be absolutely attributed to either side. For example, the same MILES weapon type code is used for machine guns for both sides.

Even allowing for the uncertainty of the data, one thing stands out. All three segments were defensive scenarios for which the killers might be assumed to be roughly equal. For the OPFOR, this is the case. For the BLUFOR, however, there is a significant difference. For segments A012 and M008, the distributions are roughly equal, with tanks being the main killer at over 60%, but for segment M019, the TOWs dominate at over 70%, relegating the tanks to less than 20%. Using this indication as a stimulus, the researcher might then use the other NTC data sources to see why there is such a difference. The other sources that could be used include the Operations Order, the Take Home Package, the NTC workstation, and the NTCDRS.

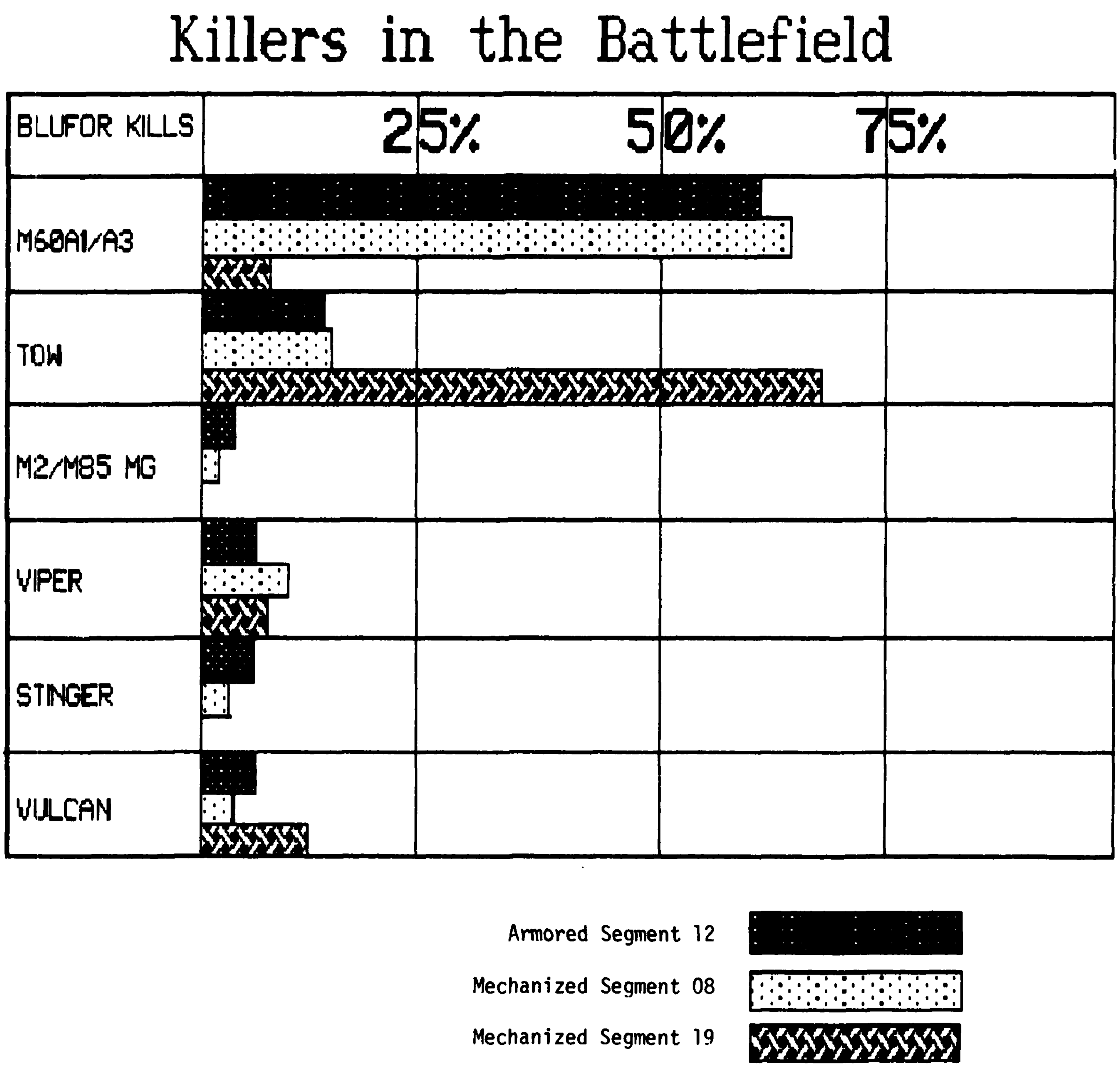

Figure III-2 BLUFOR Killers

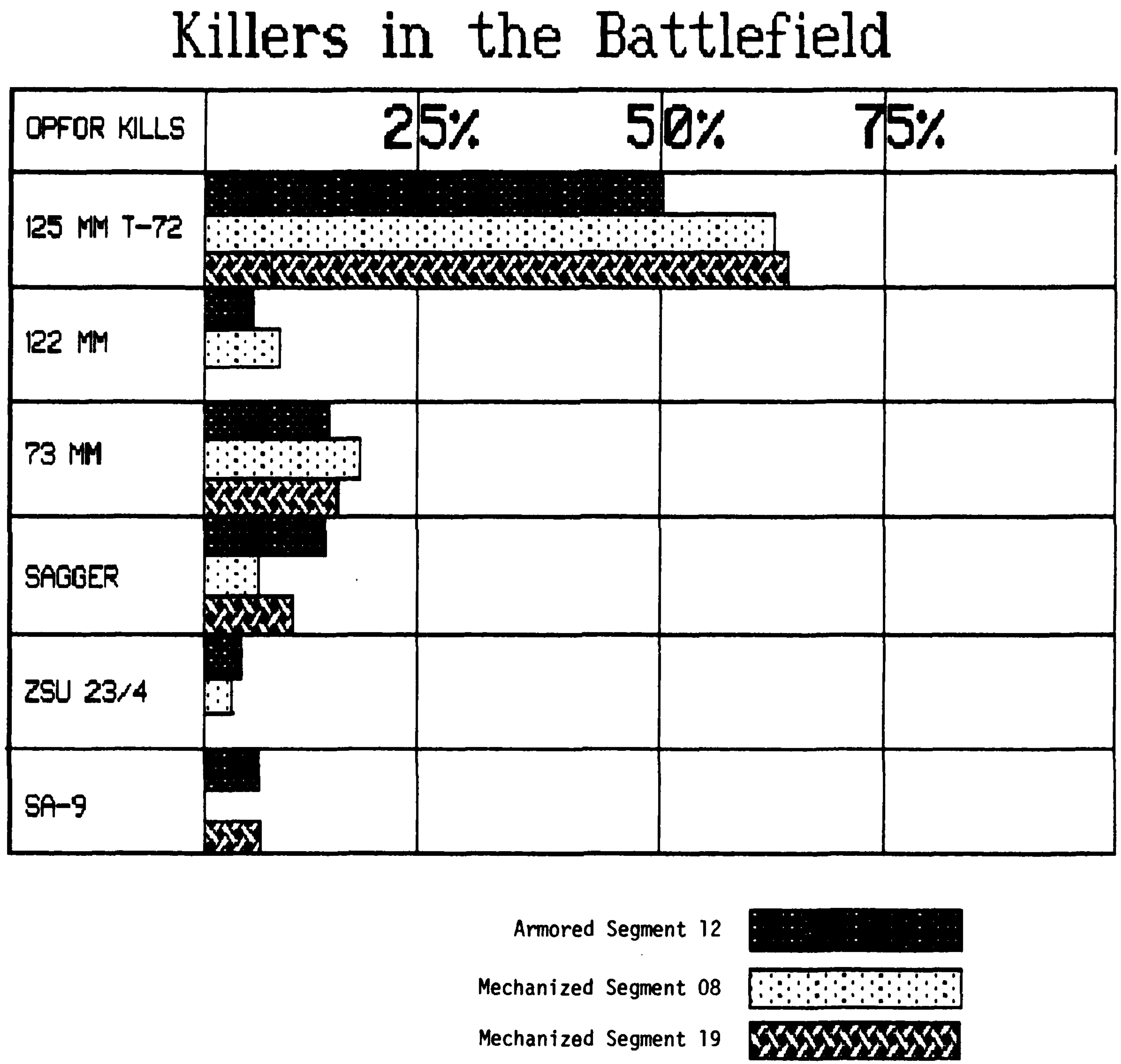

Figure III-3 OPFOR Killers

III.2.4 Delay Times

The final investigation was concerned with RDMS delay times. The delay time was defined earlier :

Delay Time - This term refers to the period of time between the occurrence of an RDMS event and the receipt of the event at the RDMS master control station (C-station). The delay time is calculated by the on-board microcomputer and passed to the C-station as part of each event message. In general, if RDMS coverage is adequate, the delay time will be less than or equal to the time between pollings, which is assumed to be 5 seconds at the NTC. When the vehicle is not in constant range or line of sight of the relay/repeater stations (A- or D- stations) however, the delay is increased significantly.

Use of the delay time allows CIS real time software to determine the event time with a great deal of accuracy, which supports firer-target pairing. In addition, the CIS software can discard those events which are so "old" as to be useless. The delay threshold used at the NTC appears, from examination of RDMS data, to be 25 seconds. Messages with delay times greater than the threshold are summarily discarded.

The comparison of RDMS and CIS data showed that there is apparently no "standard" time used in both systems. The time attached to CIS events was neither the base (C-station) time, nor the adjusted event time. It appeared to be an adjusted time, because the times between events matched for both sources, but it was consistently different, and later, than the RDMS event time.

Base data for the delay figures came from the three segments described earlier. In order to increase the sample size, the entire mission segment periods were used. Two figures are included. Figure III-4 shows a percentage distribution for events with delays less than ten seconds, and Table III-3 shows the percentage distribution of delay times from 0-100 seconds in 25 second increments.

Figure III-4 shows that the distribution of delay times under ten seconds is very similar for the three mission segments selected. It also shows that the distributions peak from two to five seconds, with approximately equal distributions at one and six seconds. The indication is that polling is not being maintained at every five seconds, but appears to be close to six seconds. This condition could be caused by a number of factors, including heavy system loading.

Table III-3 shows the percentages of delay times for messages that are retained by CIS software (less than/ equal to 25 seconds) and in 25 second increments up to 100+ seconds. This table shows that Armored Segment 12 had the worst quality, with more than 12.5% of events being deleted, while Mechanized Segment 19 had more than 98.5% events within bounds.

Table III-3 Delay Time Distribution

Delay Period (Seconds)	Mechanized Segment 08	Armored Segment 12	Mechanized Segment 19
0 - 25	93.61 %	87.36 %	98.66 %
26 - 50	1.68 %	8.17 %	0.62 %
51 - 75	0.82 %	2.59 %	0.05 %
76 +	3.89 %	1.89 %	0.67 %

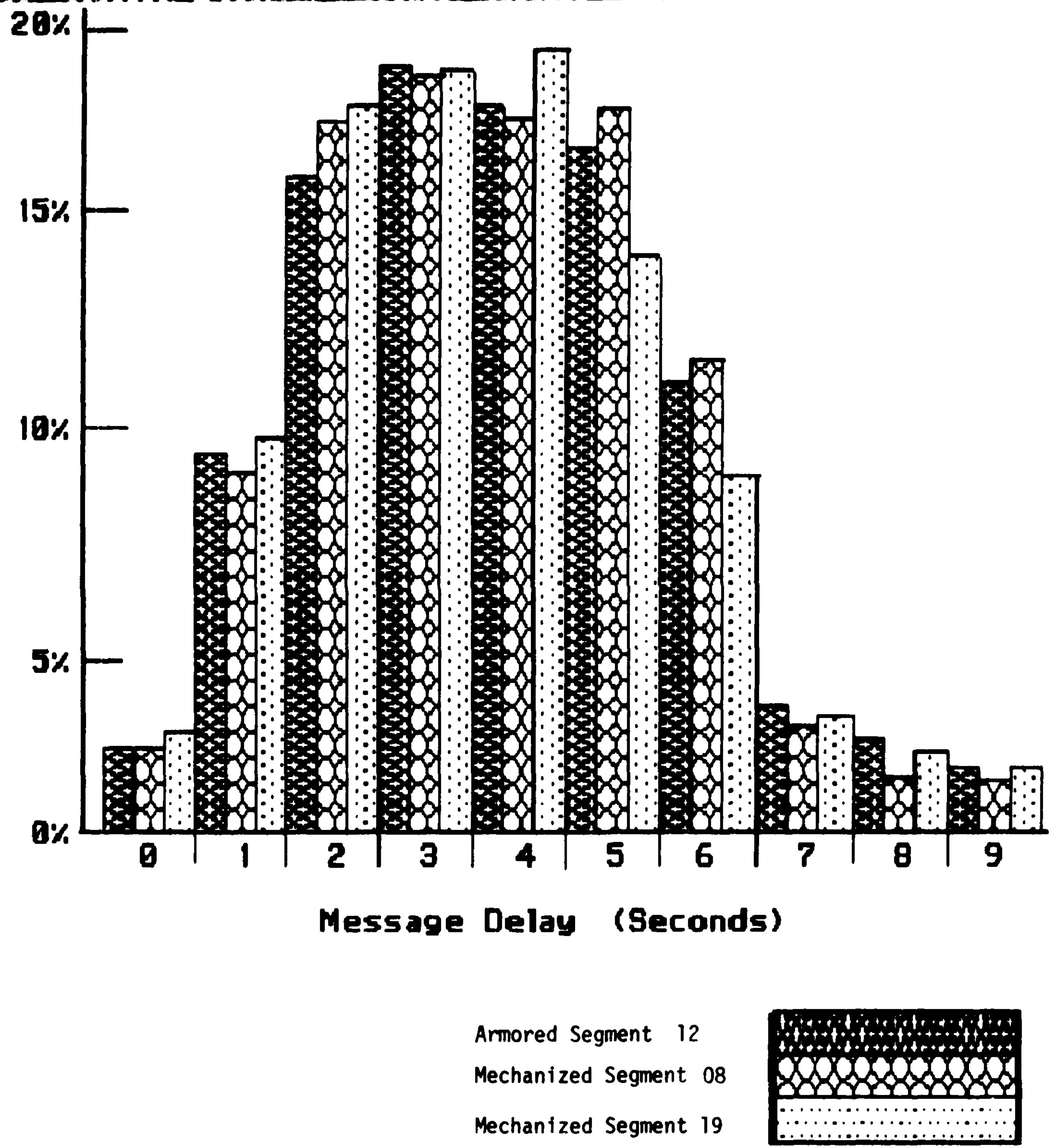

Figure III-4 Percentage Distribution of Delay Times Under Ten Seconds

IV. CONCLUSIONS

The results of the study support several conclusions:

(1) The CIS (NTCDRS) data appear to match the RDMS data with sufficient fidelity to justify the use of either data source interchangeably in research. The basis of this conclusion is the high percentage of comparison between the two sources for the data elements compared. Extrapolating this result to encompass other data elements in either, or both, sources without a closer examination of each data element is not advocated; that the level of comparison was high for the sample chosen may be seen as an indicator that the two sources are consistent, but limitations of the study indicate that more study is required before any definitive statements can be made.

(2) There are data elements available from the RDMS log that are not currently available from the CIS log. For example, while the field event PAIRING message carries a weapon type indication along with the result (HIT, NEAR MISS, or KILL), this information is not present in the NTCDRS PAIRING table. This indicates only that, if the data are present in the CIS log file data, they are not translated/ loaded into the NTCDRS table. Due to a lack of documentation on the format of the CIS log files, it is impossible to know if these data are present. If the data are not present in the CIS files, then RDMS data must be used to supplement the NTCDRS. Accordingly, retention of RDMS log tapes becomes important any future NTC research efforts.

Several other insights were gained during the course of the study. A significant amount of use of the NTCDRS left a clear impression that the design of the NTCDRS is inadequate to support the number and breadth of NTC research efforts currently contemplated. While it was possible to achieve some measure of success in using NTCDRS tables, the gains were achieved with much difficulty, owing mostly to the awkward design of the NTCDRS.

The database tables appear to support a specific, and very restricted set of reports, and most tables have proved of little use in deriving tables to generate alternative reports. The index keys to the various tables force a circuitous query structure, making the preparation of queries that seem routine very time-consuming. Some tables lack information to allow the information they contain to be used in conjunction with other tables. As one example, many of the tables use a three- character player_identification (PID) field as an index. As conditions exist presently at the NTC, these names are not unique. This makes the correlation of pairing data difficult, because although the table contains a result of a pairing against a PID, if that PID happens to be one of the duplicates, there is not enough information to ascribe the pairing to the proper player.

For example, NTCDRS access to NTC data is limited to one mission segment at a time, while several upcoming studies compare several mission segments. To accomplish this within the NTCDRS

context, the user has to create an additional database, then fill it by retrieving data from the data bases being studied. Only then can the researcher do queries and develop statistical measures.

Similarly, the NTCDRS contains only digital data from the CIS log. There are other data sources that are not digital in form, such as Take Home Packages (THPs), After Action Reviews (AARs), and communications data, that can provide invaluable information to the researcher if they can be put in a usable form and incorporated into the NTCDRS.

Finally, the quality of the NTC data is questionable, particularly for pairings. This seems to be independent of the source, as the two sources compared very well. The samples examined in this study, for example, showed that matched pairings, for which a firer was identified for a pairing event (HIT, NEAR MISS, or KILL), comprised less than 10% of the total number of pairings. Even considering the ruggedness of the Ft Irwin terrain and a natural difficulty with RDMS coverage, this seems very poor. It may be that no single cause is responsible for the poor quality, and it derives from a number of causes, including poor coverage, instrumentation failure, good cover and concealment practices, and poor time-correlation between the RDMS and CIS. Whatever the cause, the quality of the data directly affects the quality of the research that can be based on it.

APPENDIX A - FIRING DATA

This appendix contains more detailed information on the firing data comparison documented in Section III. It contains a list, per segment, of the number and type of firings per vehicle type. Notes are included to explain most discrepancies.

Task Force : Mechanized
Mission : Defend in Sector

Firing Summary For BLUFOR Players

Summary for BLUFOR Tanks (0500-0600)

Player	RDMS	-- RDMS Log --		-- CIS Log --	
Name	LPN	105MM	COAX	105MM	COAX
14D	58	44	0	44	0
13D	42	1	0	1	0
32C	38	6	0	6	0
33C	45	4	0	4	0
66C	179	2	35	2	35
TOTALS		57	35	57	35

Firing Summary For BLUFOR APCs (0500-0600)

Player	RDMS	RDMS Log	CIS Log
Name	LPN	TOW Shots	TOW Shots
E16	210	2	2

Firing Summary For OPFOR Players

Firing Summary for BMPs (0500-0600)

Player	RDMS	- RDMS Log --			-- CIS Log --			
Name	LPN	73MM	SAG	MG	73MM	SAG	MG	Notes
150	81	2	1	2	2	1	0	1
211	27	1	0	0	1	0	0	
410/	56	2	2	2	1	1	0	1,2
411					1	1	0	1,2
413	57	1	0	7	1	0	0	
414/	59	6	0	11	3	0	0	1,3
415					3	0	0	1,3
416	60	0	1	0	0	1	0	
422	62	12	3	9	12	3	0	1
870	111	2	0	2	2	0	0	1
Totals		26	7	33	26	7	0	

Firing Summary for OPFOR Tanks (0500-0600)

Player Name	RDMS LPN	-- RDMS Log -- 125MM	COAX	-- CIS Log -- 125MM	COAX	Notes
A23	90	8	38	8	29	4
B24	98	1	0	1	0	
B66	94	50	2	50	2	
D13	167	15	7	15	7	
D15	158	28	10	28	10	
D26	169	1	18	1	18	
D34	213	12	99	12	102	
D35	172	1	0	1	0	
D36	100	1	0	1	0	
HQ2	176	2	10	2	10	5
TOTALS		119	184	119	178	

OPFOR Notes :

1) Machine gun fire events reported on the RDMS log are not present in INGRES tables, either because they are not on the CIS log or because they are ignored by NTCDRS.

2) RDMS LPN 56 contributed events to two CIS PIDs, 410 and 411.

3) RDMS LPN 59 contributed events to two CIS PIDs, 414 and 415.

4) Three of the RDMS COAX fire events had unacceptable delays.

5) In addition, one fire event ascribed to a TOW weapon type was recorded on the RDMS log, and included in the INGRES FIRING table with no weapon type.

Task Force : Mechanized
Segment : 08
Mission : Defend Battle Position

Firing Summary For BLUFOR Players

Summary for BLUFOR Tanks (0500-0530)

Player Name	RDMS LPN	-- RDMS Log -- 105MM	COAX	-- CIS Log -- 105MM	COAX	Notes
32C	154	1	0	1	0	
22C	171	3	4	3	4	
21D	197	5	0	5	0	1
22D	198	16	0	16		
12C	202	3	0	2	0	2
23C	204	6	0	6	0	
TOTALS		34	4	33	4	

Firing Summary For BLUFOR APCs (0500-0530)

Player Name	RDMS LPN	RDMS Log TOW Shots	CIS Log TOW Shots	Notes
E12	116	1	1	
?	189	2	0	3
E43	231	1	1	
E44/	214	4	3	4
E45			1	4
Totals		8	6	

BLUFOR Notes:

1) RDMS LPN 197 contributed events both for PID 21D, a BLUFOR tank, and for PID 680, an OPFOR BMP.

2) One fire event for LPN 202 was deleted by the CIS because of excessive delay time.

3) RDMS LPN 189 had two TOW shots. Both had excessive delay times, causing the CIS software to discard them.

4) RDMS Logical Player number 214 events were applied to both player E44 and player E45 at the CIS.

Task Force : Mechanized
Segment : 08
Mission : Defend Battle Position

Firing Summary For OPFOR Players

Firing Summary for BMPs (0500-0530)

Player	RDMS	- RDMS Log --			-- CIS Log --			
Name	LPN	73MM	SAG	MG	73MM	SAG	MG	Notes
322	41	8	1	0	8	1	0	
323	42	1	0	0	1	0	0	
325/	43	10	0	0	2	0	0	1
326					8	0	0	1
327	44	3	0	0	3	0	0	
331	45	9	0	0	9	0	0	
334	46	1	0	0	1	0	0	
336	47	1	0	0	1	0	0	
350	48	1	0	0	1	0	0	
680	197	4	0	0	4	0	0	2
Totals		38	1	0	38	1	0	

Firing Summary for OPFOR Tanks (0500-0530)

Player	RDMS	-- RDMS Log --		-- CIS Log --		
Name	LPN	125MM	COAX	125MM	COAX	Notes
D23	56	11	11	11	11	
?	76	1	0			3
A16	79	2	0	2	0	
A24	81	1	0	1	0	
A36	84	0	34	0	6	4
B65	85	1	0	1	0	
B24	88	1	0	1	0	
B33	90	4	0	4	0	
D16	99	1	0	1	0	
HQ2	102	4	0	4	0	
D15	215	3	0	3	0	
TOTALS		29	45	28	17	

Firing Summary for OPFOR ZSU 23-4 (0500-0530)

Player	RDMS	RDMS	CIS
Name	LPN	Log	Log
343	74	3	3

Task Force : Mechanized
Segment : 08
Mission : Defend Battle Position

OPFOR Notes :

1) RDMS LPN 43 contributed events to PID 325 and PID 326. There were also 22 SA-9 (BRDM) FIRE events from this player, all but one of which had excessive delay times. The remaining event did not match any FIRING table entries.

2) RDMS LPN 197 contributed events both for PID 21D, a BLUFOR tank, and for PID 680, an OPFOR BMP.

3) RDMS LPN 76 had one apparently valid T72 fire event which did not match any FIRING table entries.

4) RDMS LPN 84 Had 34 COAX FIRE events, all at the same time (05:01:47). 29 had delay times greater than 25 seconds and were candidates for deletion by CIS software. The remaining 5 RDMS events did not match directly with the 6 CIS events.

Rotation : 85-10 Task Force : Armored
Segment : 12 Mission : Defend in Sector

Firing Summary For BLUFOR Players

Summary for BLUFOR Tanks (0500-0600)

Player	RDMS	-- RDMS Log --		-- CIS Log --		
Name	LPN	105MM	COAX	105MM	COAX	Notes
A13	127	15	0	15	0	
A21	128	28	0	28	0	
A23	106	23	0	23	0	
A31	107	6	0	6	0	
A35	188	0	1	0	1	
A66	125	38	0	38	0	
B14/	135	57	0	40	0	1
B21				15	0	1
B22/	136	27	0	26	0	2
B23				1	0	2
B24	145	14	3	14	3	
B66/	132	55	0	45	0	3
A34				10	1	3
H65	119	31	0	31	0	
H66	118	15	0	15	0	
TOTALS		309	4	307	5	

Firing Summary For BLUFOR APCs (0500-0600)

Player	RDMS	RDMS Log	CIS Log	
Name	LPN	TOW Shots	TOW Shots	Notes
E36	104	11	10	4
E42	88	2	2	
Totals		13	12	

BLUFOR Notes:

1) RDMS Logical Player number 135 events were applied to both player B14 and player B21 at the CIS. Two RDMS log events had excessive delay times and were apparently discarded by the CIS. Two more events have no apparent match in the INGRES FIRING table, however two events that appear in the INGRES table have no apparent match in RDMS log data.

2) RDMS Logical Player number 136 events were applied to both player B22 and player B23 at the CIS.

3) RDMS Logical Player Number 132 events were applied to CIS players A34 and B66. A34 had one COAX firing event in the INGRES table that was not in the RDMS data.

4) One RDMS fire event had an excessive delay time (128 seconds) and was discarded by the CIS.

Task Force : Armored
Segment : 12
Mission : Defend in Sector

Firing Summary For OPFOR Players

Firing Summary for BMPs (0500-0600)

Player	RDMS	- RDMS Log --			-- CIS Log --			
Name	LPN	73MM	SAG	MG	73MM	SAG	MG	Notes
120	16	1	0	39	1	0	0	1
121	17	2	0	0	2	0	0	
132	21	1	0	0	1	0	0	
133	22	7	0	12	7	0	0	1
150	25	0	2	0	0	2	0	
210	24	0	2	0	0	2	0	
216	91	1	1	0	1	1	0	
217	34	1	2	0	1	2	0	
220	28	4	0	38	4	0	0	1
227	57	0	1	0	0	1	0	
230	33	13	3	0	12	2	0	2
250	36	5	3	0	5	3	0	
311	151	1	0	0	1	0	0	
312	167	7	0	21	7	0	0	1
323	187	2	0	2	2	0	0	1
325	190	3	0	2	3	0	0	1
326	8	1	0	0	1	0	0	
330	197	1	0	0	1	0	0	
333	25	3	1	9	3	1	0	1
336	198	8	0	16	8	0	0	1
337	196	15	0	13	15	0	0	1
411	49	5	0	1	5	0	0	1
414	50	1	0	0	1	0	0	
422	95	1	0	0	1	0	0	
430	47	1	0	3	1	0	0	1
435	55	1	0	0	1	0	0	
650	83	5	0	5	5	0	0	1
871	111	12	0	50	12	0	0	1
HQ3	1	3	0	0	3	0	0	
HQ6	82	0	1	0	0	1	0	
Totals		104	16	111	103	15	0	

Firing Summary for OPFOR Tanks (0500-0600)

Player Name	RDMS LPN	-- RDMS Log -- 125MM	COAX	-- CIS Log -- 125MM	COAX	Notes
A23	206	3	56	3	24	3
B13	70	2	2	2	2	
B14	87	6	62	6	26	4
B35	174	7	14	7	14	
B36	89	16	18	16	8	5
D13	214	5	0	5	0	
D14	78	13	0	13	0	
D16	79	15	0	15	0	
D23	97	14	0	14	0	
D33/	100	1	130	1	0	6
D34				0	128	6
TOTALS		82	282	82	200	

OPFOR Notes :

1) Machine gun fire events reported on the RDMS log are not present in INGRES tables, either because they are not on the CIS log or becasue they are ignored by NTCDRS.

2) One 73MM fire event and one SAGGER fire event for player 230 were discarded by CIS software because the delays between the time the events happened and the time they were received by the RDMS C-Station exceeded 25 seconds.

3) Player A23 matched all 125MM firings. Coax firings mismatched primarily because of excessive delay times. Of the 56 COAx firing events, only 21 had acceptable delays (less than/ equal to 25 seconds). This means that the INGRES FIRING table had 3 more coax firings than it should have.

4) Player B14 matched all main gun firings, but mismatched on the coax fire events due to excessive delay times. For player B14, 26 coax fire events had acceptable delay times (less than/ equal to 25 seconds), meaning that the two sources matched exactly.

5) Player B36 matched all main gun firings, but mismatched on the coax fire events due to excessive delay times. For player B36, 9 coax fire events had acceptable delay times (less than/ equal to 25 seconds), leaving one RDMS event unmatched.

6) RDMS LPN 100 contributed events to CIS players D33 and D34. Two RDMS coax fire events were left unpaired for this player. Delays were within limits for all events.

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APPENDIX B - PAIRING DATA

This appendix contains more detailed information on the pairing data comparison documented in Section III. It contains a complete listing of all pairings contained in either the RDMS tape data or the NTCDRS PAIRING table for the time segment selected.

Rotation 8510, Mechanized Segment 8 Pairings

R D M S Log					N T C D R S P A I R I N G				Table	
Date	Time	LPN	Result		Time	Result	Fir	Tar	Weapon	Range
6 Jun	05:01:20	52	N-M	Heavy	05:01:24	N-M	-	31C	-	-
6 Jun	05:00:26	37	KILL	TOW/AT-6/HIND	(Excessive Delay = 71 seconds)					
6 Jun	04:56:26	202K	KILL	M16, M60 MG, Coax	(Excessive Delay = 318 seconds)					
6 Jun	05:01:51	154	N-M	Heavy	05:01:55	N-M	-	32C	-	-
6 Jun	05:02:10	171K	N-M	Heavy	05:02:19	N-M	-	22C	-	-
6 Jun	04:57:45	202K	KILL	DRAGON/Spandrel	(Excessive Delay = 285 seconds)					
6 Jun	05:03:44	113	KILL	TO/ AT-6/HIND	05:03:58	KILL	E43	522	TOW	0.813
6 Jun	05:04:58	28	N-M	DRAGON/Spandrel	05:05:19	N-M	-	217	-	-
6 Jun	05:05:35	208	N-M	Heavy	05:05:40	N-M	-	E13	-	-
6 Jun	05:06:04	170	N-M	Light	05:06:09	N-M	-	SC1	-	-
6 Jun	05:06:06	170	N-M	Light	05:06:11	N-M	-	SC1	-	-
6 Jun	05:06:07	170	N-M	Light	05:06:12	N-M	-	SC1	-	-
							-	D16	-	-
					05:06:48	HIT	-	D16	-	-
					05:06:49	HIT	-	HG2	-	-
6 Jun	05:07:04	183	N-M	Heavy	05:07:08	N-M	-	B23	-	-
6 Jun	05:07:05	183	N-M	Light	05:07:10	N-M	-	B23	-	-
6 Jun	05:07:21	12	HIT	M2, M85 MG	05:07:25	HIT	-	HG3	-	-
6 Jun	05:07:36	183	N-M	Heavy	05:07:40	N-M	-	B23	-	-
6 Jun	05:07:37	183	N-M	Light spare	05:07:42	N-M	-	B23	-	-
6 Jun	05:07:38	183	N-M	Light	05:07:43	N-M	-	B23	-	-
6 Jun	05:07:39	183	N-M	Light spare	05:07:44	N-M	-	B23	-	-
6 Jun	05:07:41	183	N-M	Light spare	05:07:45	N-M	-	B23	-	-
6 Jun	05:07:32	73	N-M	Sagger - BMP	05:07:53	N-M	-	682	-	-
6 Jun	05:08:00	183	N-M	Heavy	05:08:04	N-M	-	B23	-	-
6 Jun	05:07:44	73	N-M	TOW/AT-6/HIND	05:08:05	N-M	-	682	-	-
6 Jun	05:08:01	183	N-M	Light spare	05:08:05	N-M	-	B23	-	-
6 Jun	05:08:02	183	N-M	Heavy spare	05:08:06	N-M	-	B23	-	-
6 Jun	05:08:16	28	HIT	M60A1/A3, M48A5	05:08:20	HIT	-	217	-	-
6 Jun	05:03:32	109	KILL	30MM HIND/ Vulcan	(Excessive Delay = 327 seconds)					
6 Jun	05:07:53	162	KILL	M2, M85 MG	(Excessive Delay = 102 seconds)					
6 Jun	05:09:35	182	N-M	Heavy spare	05:09:39	N-M	-	B26	-	-
6 Jun	05:02:19	162	HIT	122MM M1974	(Excessive Delay = 577 seconds)					
6 Jun	05:12:58	179	N-M	Light	05:13:06	N-M	-	B66	-	-
6 Jun	05:14:41	213	N-M	Light	05:14:50	N-M	-	E43	-	-
6 Jun	05:14:48	213	N-M	TOW - MILES	05:14:53	N-M	-	E43	-	-
6 Jun	05:14:49	213	KILL	TOW - MILES	05:14:53	KILL	-	E43	-	-
6 Jun	05:14:52	213	N-M	Light	05:14:57	N-M	-	E43	-	-
6 Jun	05:15:06	213	N-M	Light	05:15:11	N-M	-	E43	-	-
6 Jun	05:15:09	213	N-M	Light	05:15:14	N-M	-	E43	-	-
6 Jun	05:15:17	213	N-M	Light						
					05:15:16	HIT	-	E43	-	-
6 Jun	05:15:17	213	N-M	TOW - MILES	05:15:21	N-M	-	E43	-	-
6 Jun	05:15:20	213	N-M	Light	05:15:21	N-M	-	E43	-	-
6 Jun	05:15:20	213	N-M	TOW - MILES	05:15:24	N-M	-	E43	-	-
6 Jun	05:15:22	213	N-M	Sagger - BMP	05:15:25	N-M	-	E43	-	-
6 Jun	05:15:23	213	N-M	Light	05:15:28	N-M	-	E43	-	-
6 Jun	05:15:25	213	N-M	Light	05:15:29	N-M	-	E43	-	-
6 Jun	05:15:25	213	N-M	TOW - MILES	05:15:30	N-M	-	E43	-	-
6 Jun	05:15:21	17	N-M	Sagger - BMP	05:15:42	N-M	-	120	-	-
6 Jun	05:15:40	213	N-M	TOW - MILES	05:15:42	N-M	-	E43	-	-
6 Jun	05:15:41	213	N-M	TOW - MILES	05:15:44	N-M	-	E43	-	-
6 Jun	05:15:41	213	N-M	TOW - MILES	05:15:45	N-M	-	E43	-	-
6 Jun	05:15:41	213	N-M	Light	05:15:45	N-M	-	E43	-	-
6 Jun	05:15:41	213	N-M	TOW - MILES	05:15:46	N-M	-	E43	-	-
6 Jun	05:15:42	213	N-M	TOW - MILES	05:15:46	N-M	-	E43	-	-

					05:15:46	N-M	-	E43	-	-
6 Jun	05:15:42	213	KILL	TOW - MILES	05:15:46	KILL	-	E43	-	-
					05:16:21	HIT	-	HG2	-	-
6 Jun	05:15:21	17	N-M	Sagger - BMP	(Excessive Delay = 43 seconds)					
6 Jun	05:16:28	213	KILL	TOW - MILES	05:16:32	KILL	-	E43	-	-
6 Jun	05:16:35	213	N-M	Light	05:16:39	N-M	-	E43	-	-
					05:16:40	HIT	-	E43	-	-
6 Jun	05:16:42	213	N-M	Light	05:16:47	N-M	-	E43	-	-
6 Jun	05:16:44	213	N-M	Light	05:16:48	N-M	-	E43	-	-
6 Jun	05:16:45	198K	N-M	TOW/AT-6/HIND	05:17:06	N-M	-	23D	-	-
6 Jun	05:17:13	75	N-M	Light	05:17:17	N-M	-	641	-	-
					05:17:51	HIT	-	217	-	-
6 Jun	05:18:57	42	N-M	Heavy	05:19:02	N-M	14D	324	105 MM	1.075
6 Jun	05:19:28	42	HIT	M60A1/A3, M48A5	05:19:34	HIT	14D	324	105 MM	1.188
6 Jun	05:19:43	164	KILL	Controller Gun						
6 Jun	05:18:38	162	KILL	M2, M85 MG	(Excessive Delay = 109 seconds)					
6 Jun	05:20:48	58K	N-M	Heavy spare	05:20:54	N-M	-	14D	-	-
					05:21:00	KILL	-	112	-	-
6 Jun	05:23:20	183	N-M	Heavy spare	05:23:26	N-M	-	B23	-	-
6 Jun	05:23:21	183	N-M	Heavy	05:23:27	N-M	-	B23	-	
6 Jun	05:17:53	202K	KILL	M16, M60 MG, Coax	(Excessive Delay = 354 seconds)					
6 Jun	05:23:44	119	KILL	Controller Gun						
6 Jun	05:24:02	197K	N-M	Heavy spare	05:24:07	N-M	-	680	-	-
6 Jun	05:19:12	202K	KILL	DRAGON/Spandrel	(Excessive Delay = 325 seconds)					
6 Jun	05:24:41	210	N-M	Heavy	05:24:47	N-M	-	E16	-	-
6 Jun	05:24:45	197K	HIT	M60A1/A3, M48A5	05:24:51	HIT	14D	680	105 MM	0.488
					05:24:58	N-M	-	E16	-	-
6 Jun	05:24:58	170	KILL	M60A1/A3, M48A5	05:25:03	KILL	-	SC1	-	-
6 Jun	05:24:57	170	N-M	Light	05:25:04	N-M	-	SC1	-	-
6 Jun	05:24:58	170	HIT	M60A1/A3, M48A5						
					05:25:14	N-M	-	217	-	-
6 Jun	05:25:09	213	N-M	Light	05:25:15	N-M	-	E43	-	-
6 Jun	05:25:15	83	N-M	DRAGON/Spandrel	05:25:37	N-M	-	A33	-	-
6 Jun	05:25:56	58K	HIT	73MM BMP	05:26:02	HIT	-	14D	-	-
					05:26:03	KILL	-	14D	-	-
6 Jun	05:25:50	28	N-M	TOW/AT-6/HIND	05:26:09	N-M	-	217	-	-
					05:26:12	N-M	-	217	-	-
6 Jun	05:26:37	73	N-M	Heavy	05:26:42	N-M	-	682	-	-
6 Jun	05:26:46	73	KILL	Controller Gun						
6 Jun	05:27:00	16	N-M	TOW/AT-6/HIND	05:27:22	N-M	-	116	-	-
6 Jun	05:27:21	210	N-M	Sagger - BMP	05:27:43	N-M	-	E16	-	-
6 Jun	05:28:19	12	KILL	M60A1/A3, M48A5	05:28:25	KILL	23C	H93	105 MM	1.150
6 Jun	05:28:16	213	N-M	Light	05:28:22	N-M	-	E43	-	-
6 Jun	05:28:18	213	N-M	Light	05:28:24	N-M	-	E43	-	-
6 Jun	05:28:19	213	N-M	Light	05:28:26	N-M	-	E43	-	-
6 Jun	05:28:22	213	N-M	Light	05:28:28	N-M	-	E43	-	-
6 Jun	05:28:30	213	N-M	Light	05:28:36	N-M	-	E43	-	-
6 Jun	05:28:33	213	N-M	Light	05:28:39	N-M	-	E43	-	-
6 Jun	05:28:51	33	N-M	M60A1/A3, M48A5	05:28:58	N-M	14D	231	105 MM	5.363
6 Jun	05:29:08	32	HIT	M60A1/A3, M48A5						
6 Jun	05:29:08	32	KILL	M60A1/A3, M48A5	05:29:13	KILL	14D	230	105 MM	0.800
6 Jun	05:29:28	16	N-M	Light	05:29:34	N-M	-	116	-	-
					05:30:09	N-M	-	A65	-	-
6 Jun	05:29:47	76	N-M	TOW/AT-6/HIND	05:30:09	N-M	-	653	-	-

Rotation 8510, Mechanized Segment 19 Pairing Correlation

RDMS Date	RDMS Time	RDMS LPN	Log Result	Log	NTCDRS Time	Result	Fir	Tar	Table Weapon	Range (KM)
15 Jun	05:00:16	163	KILL	Sagger BMP	(Excessive Delay = 31 Seconds)					
15 Jun	05:01:52	179	NM	DRAGON/Spandrel BRDM	05:02:29	N/M	-	66C	-	
15 Jun	05:01:54	163	HIT	Stinger	(Excessive Delay = 239 Seconds)					
15 Jun	05:02:51	179	NM	DRAGON/Spandrel BRDM	05:03:27	N/M	-	66C	-	
15 Jun	05:03:11	179	NM	DRAGON/Spandrel BRDM	05:03:48	N/M	-	66C	-	
15 Jun	05:03:38	179	HIT	DRAGON/Spandrel BRDM	05:04:04	HIT	-	66C	-	
15 Jun	05:03:58	24	NM	H W	05:04:18	N/M	-	22C	-	
15 Jun	05:05:54	24	NM	H W	05:06:14	N/M	-	22C	-	
15 Jun	05:06:04	24	NM	H W	05:06:24	FRAT	14D	22C	105 MM	2.525
15 Jun	05:06:10	24	NM	H W	05:06:30	FRAT	14D	22C	105 MM	2.500
15 Jun	05:06:16	24	NM	H W	05:06:37	FRAT	14D	22C	105 MM	2.450
15 Jun	05:06:40	24	NM	H W	05:07:01	FRAT	14D	22C	105 MM	2.388
15 Jun	05:06:56	24	NM	H W	05:07:16	FRAT	14D	22C	105 MM	2.238
15 Jun	05:06:42	45	NM	DRAGON/Spandrel BRDM	05:07:19	N/M	-	33C	-	
15 Jun	05:06:53	82	NM	DRAGON/Spandrel BRDM	05:07:30	N/M	-	653	-	
15 Jun	05:07:15	24	NM	H W	05:07:36	FRAT	14D	22C	105 MM	2.100
15 Jun	05:07:26	24	NM	H W	05:07:46	FRAT	14D	22C	105 MM	2.038
15 Jun	05:07:33	24	HIT	M60A1/A3, M48A5	05:07:54	FRAT	14D	22C	105 MM	1.963
15 Jun	05:07:34	116	KILL	Controller Gun						
					*05:07:57	KILL	-	450	-	
15 Jun	05:07:49	24	NM	H W	05:08:10	FRAT	14D	22C	105 MM	1.888
15 Jun	05:07:56	181	HIT	Viper	05:08:16	HIT	-	150	-	
15 Jun	05:08:05	24	HIT	M60A1/A3, M48A5	05:08:25	FRAT	14D	22C	105 MM	1.788
15 Jun	05:08:13	24	NM	H W	05:08:33	FRAT	14D	22C	105 MM	1.738
15 Jun	05:08:20	128	HIT	ZSU 234 (visual mode)	(Excessive Delay = 376 Seconds)					
15 Jun	05:08:28	24	KILL	M60A1/A3, M48A5	*05:08:48	FRAT	14D	22C	105 MM	1.638
15 Jun	05:08:54	29	KILL	Controller Gun	*					
					05:09:00	N/M	-	214	-	
15 Jun	05:09:08	45	NM	H W	05:09:28	FRAT	14D	33C	105 MM	1.413
15 Jun	05:09:19	179	NM	H W	05:09:39	N/M	-	66C	-	
15 Jun	05:09:20	179	NM	H W	05:09:41	N/M	-	66C	-	
15 Jun	05:09:21	179	NM	H W	05:09:42	N/M	-	66C	-	
15 Jun	05:09:25	179	NM	H W	05:09:45	N/M	-	66C	-	
15 Jun	05:09:26	179	NM	H W S	05:09:46	N/M	-	66C	-	
15 Jun	05:09:28	179	NM	H W	05:09:48	N/M	-	66C	-	
15 Jun	05:09:29	179	NM	H W S	05:09:49	N/M	-	66C	-	
15 Jun	05:09:36	179	KILL	Controller Gun	*					
15 Jun	05:10:26	158	NM	TOW /AT6/HIND	05:11:02	N/M	-	D15	-	
					05:12:05	KILL	-	66C	-	
15 Jun	05:12:20	100	KILL	TOW /AT6/HIND	*05:12:51	KILL	-	D36	-	
15 Jun	05:13:01	157	NM	H W	05:13:22	FRAT	14D	13C	105 MM	2.263
15 Jun	05:13:33	172	KILL	TOW /AT6/HIND	*05:14:03	KILL	-	D35	-	
15 Jun	05:13:49	59	HIT	30MM HIND/20MM/ Vulcan	05:14:10	HIT	-	414	-	
15 Jun	05:13:48	38	KILL	TOW /AT6/HIND	*05:14:18	KILL	-	232	-	
15 Jun	05:14:03	143	NM	L W	05:14:31	N/M	-	B31	-	
15 Jun	05:15:05	96	NM	H W	05:15:26	N/M	-	611	-	
15 Jun	05:15:06	96	NM	L W	05:15:27	N/M	-	611	-	
15 Jun	05:15:15	115	KILL	125MM T72	*05:15:35	KILL	D34	C26	125 MM	1.113
15 Jun	05:15:20	111	NM	L W	05:15:41	N/M	-	870	-	
15 Jun	05:15:53	216	NM	H W	05:16:13	N/M	-	B34	-	
					05:16:20	N/M	-	B34	-	
15 Jun	05:16:37	45	KILL	DRAGON/Spandrel BRDM	*05:17:03	KILL	-	33C	-	
15 Jun	05:17:52	175	HIT	125MM T72	(Duplicate with KILL)					
15 Jun	05:17:52	175	KILL	125MM T72	*05:18:12	KILL	D34	CEV	125 MM	0.225
15 Jun	05:18:42	111	NM	L W	05:19:03	HIT	-	870	-	
15 Jun	05:18:43	111	HIT	30MM HIND/20MM/ Vulcan	05:19:03	N/M	-	870	-	

15 Jun 05:18:43	111	HIT	30MM HIND/20MM/ Vulcan	(Duplicate with KILL)					
15 Jun 05:18:43	111	KILL	30MM HIND/2CMM/ Vulcan	*05:19:03	KILL	-	870	-	
15 Jun 05:18:47	157	HIT	73MM BMP	05:19:07	HIT	-	13C	-	
15 Jun 05:18:57	168	NM	TOW /AT6/HIND	05:19:34	N/M	-	D24	-	
15 Jun 05:21:33	59	NM	DRAGON/Spandrel BRDM	05:22:10	N/M	-	414	-	
15 Jun 05:21:56	52	NM	DRAGON/Spandrel BRDM	05:22:32	N/M	-	31C	-	
15 Jun 05:22:45	52	KILL	DRAGON/Spandrel BRDM	*05:23:11	KILL	-	31C	-	
				05:24:56	HIT	-	414	-	
15 Jun 05:24:47	83	KILL	TOW /AT6/HIND	*05:25:17	KILL	-	682	-	
15 Jun 05:25:16	64	KILL	TOW /AT6/HIND	*05:25:46	KILL	-	430	-	
				*05:26:46	KILL	-	B66	-	
15 Jun 05:26:36	143	NM	H W S	05:26:56	N/M	-	B31	-	
15 Jun 05:28:46	59	NM	TOW /AT6/HIND	05:29:21	N/M	-	414	-	
15 Jun 05:28:46	59	NM	TOW /AT6/HIND	(Excessive Delay = 64 Seconds)					
15 Jun 05:29:46	59	NM	TOW /AT6/HIND	05:30:22	N/M	-	414	-	
				05:32:09	HIT	-	450	-	
15 Jun 05:31:50	69	HIT	ZSU 234 (visual mode)	05:32:09	HIT	-	450	-	
15 Jun 05:32:10	59	NM	DRAGON/Spandrel BRDM	05:32:46	N/M	-	414	-	
				*05:32:53	KILL	-	450	-	
				05:33:05	N/M	-	414	-	
15 Jun 05:33:09	28	NM	L W	05:33:29	N/M	-	213	-	
15 Jun 05:33:11	28	NM	L W	05:33:31	N/M	-	213	-	
15 Jun 05:33:38	143	NM	DRAGON/Spandrel BRDM	05:34:14	N/M	-	B31	-	
15 Jun 05:34:14	27	NM	TOW /AT6/HIND	05:34:50	N/M	-	210	-	
15 Jun 05:34:45	27	NM	TOW /AT6/HIND	05:35:20	N/M	-	210	-	
15 Jun 05:35:12	23	NM	L W	05:35:32	N/M	-	131	-	
15 Jun 05:35:14	23	NM	L W	05:35:34	N/M	-	131	-	
15 Jun 05:35:47	122	NM	H W S						
15 Jun 05:36:04	85	NM	L W	05:36:24	N/M	-	641	-	
15 Jun 05:36:08	85	NM	L W	05:36:28	N/M	-	641	-	
15 Jun 05:36:09	85	NM	L W	05:36:29	N/M	-	641	-	
15 Jun 05:36:11	85	NM	L W	05:36:31	N/M	-	641	-	
15 Jun 05:36:31	106	NM	H W S						
15 Jun 05:36:56	130	NM	H W S						
15 Jun 05:37:18	178	KILL	125MM T72	*05:37:38	KILL	D34	S03	125 MM	0.163
15 Jun 05:37:27	174	NM	L W	05:37:46	N/M	-	860	-	
15 Jun 05:37:30	174	NM	H W S	05:37:49	N/M	-	860	-	
15 Jun 05:38:18	53	NM	L W	05:38:38	N/M	-	C31	-	
15 Jun 05:38:16	128	NM	H W						
15 Jun 05:38:32	143	NM	L W	05:38:52	N/M	-	B31	-	
15 Jun 05:38:52	143	NM	L W	05:39:12	N/M	-	B31	-	
15 Jun 05:38:53	143	NM	L W	05:39:13	N/M	-	B31	-	
15 Jun 05:38:53	106	NM	L W						
15 Jun 05:38:59	143	NM	L W	05:39:19	N/M	-	B31	-	
15 Jun 05:39:01	143	NM	L W	05:39:21	N/M	-	B31	-	
15 Jun 05:39:44	143	NM	L W	05:40:52	N/M	-	B31	-	
15 Jun 05:39:46	143	NM	L W	05:40:54	N/M	-	B31	-	
15 Jun 05:39:46	143	NM	L W	(Excessive Delay = 185 seconds)					
15 Jun 05:40:43	182	HIT	73MM BMP	05:41:50	HIT	-	B26	-	
15 Jun 05:40:57	213	NM	H W	05:42:05	N/M	14D	D34	105 MM	0.263
15 Jun 05:41:16	8	HIT	TOW /AT6/HIND	05:42:26	N/M	-	HQ3	-	
15 Jun 05:41:18	8	NM	M16, M60 MG, Coax	05:42:34	HIT	-	HQ3	-	
				*05:43:21	KILL	-	14D	-	
15 Jun 05:42:17	53	KILL	125MM T72	*05:43:24	KILL	D26	C31	125 MM	0.963
15 Jun 05:42:30	174	KILL	TOW /AT6/HIND	*05:43:47	KILL	E16	860	TOW	0.238
15 Jun 05:42:45	143	NM	H W S	05:43:53	N/M	-	B31	-	
15 Jun 05:42:47	143	NM	L W	05:43:54	N/M	-	B31	-	
15 Jun 05:42:48	143	NM	L W	05:43:56	N/M	-	B31	-	
15 Jun 05:42:50	143	NM	L W	05:43:57	N/M	-	B31	-	
15 Jun 05:42:56	143	NM	L W	05:44:04	N/M	-	B31	-	
15 Jun 05:42:58	143	NM	L W	05:44:06	N/M	-	B31	-	

15 Jun 05:42:56	143	NM	L W		05:44:04	N/M	-	B31	-	
15 Jun 05:42:58	143	NM	L W		05:44:06	N/M	-	B31	-	
15 Jun 05:42:59	37	NM	DRAGON/Spandrel BRDM		05:44:06	N/M	-	231	-	
15 Jun 05:42:59	37	NM	DRAGON/Spandrel BRDM		05:44:06	N/M	-	231	-	
15 Jun 05:43:03	37	NM	DRAGON/Spandrel BRDM		05:44:10	N/M	-	231	-	
15 Jun 05:43:18	37	NM	DRAGON/Spandrel BRDM		05:44:22	N/M	-	231	-	
					05:44:23	N/M	-	231	-	
					05:44:25	N/M	-	231	-	
					05:44:27	N/M	-	231	-	
					05:44:42	N/M	-	231	-	
15 Jun 05:44:45	62	NM	L W		05:45:53	N/M	-	422	-	
15 Jun 05:44:59	62	NM	L W		05:46:07	N/M	-	422	-	
15 Jun 05:45:25	62	NM	L W		05:46:33	N/M	-	422	-	
15 Jun 05:45:32	62	NM	L W		05:46:40	N/M	-	422	-	
15 Jun 05:46:02	158	NM	L W							
15 Jun 05:46:04	158	NM	L W							
15 Jun 05:46:10	158	NM	L W	S						
15 Jun 05:46:18	158	NM	L W							
15 Jun 05:46:23	158	NM	H W	S						
15 Jun 05:46:25	158	NM	L W	S						
15 Jun 05:46:28	158	NM	H W	S						
					*05:47:34	KILL	-	450	-	
15 Jun 05:46:33	37	NM	DRAGON/Spandrel BRDM		05:47:40	N/M	-	231	-	
15 Jun 05:46:35	138	NM	H W		05:47:42	N/M	-	32C	-	
15 Jun 05:46:35	138	NM	H W		(Excessive Delay = 147 Seconds)					
					05:47:57	N/M	-	231	-	
15 Jun 05:46:40	158	KILL	Controller Gun							
15 Jun 05:47:15	65	KILL	Controller Gun		*					
15 Jun 05:47:40	68	KILL	TOW /AT6/HIND		05:48:52	N/M	-	11C	-	
15 Jun 05:47:45	201	NM	H W		*05:48:57	KILL	-	436	-	
15 Jun 05:48:33	62	NM	L W		05:49:41	N/M	-	422	-	
15 Jun 05:48:36	62	NM	L W		05:49:44	N/M	-	422	-	
15 Jun 05:48:45	62	NM	L W		05:49:52	N/M	-	422	-	
15 Jun 05:48:50	62	NM	L W		05:49:57	N/M	-	422	-	
15 Jun 05:49:43	69	NM	L W	S	05:50:50	N/M	-	450	-	
15 Jun 05:49:44	69	NM	H W	S	05:50:51	N/M	-	450	-	
15 Jun 05:49:54	56	NM	H W		05:51:02	N/M	-	411	-	
15 Jun 05:49:57	56	NM	H W		05:51:04	N/M	-	410	-	
15 Jun 05:50:00	143	NM	H W		(Excessive Delay = 35 Seconds)					
15 Jun 05:50:01	28	HIT	73MM BMP		05:51:09	HIT	-	213	-	
15 Jun 05:50:01	28	KILL	Controller Gun		*					
15 Jun 05:50:32	158	HIT	Viper		05:51:39	HIT	-	D15	-	
15 Jun 05:50:34	158	NM	H W		05:51:41	N/M	-	D15	-	
15 Jun 05:50:35	56	HIT	Viper		(Duplicate with KILL)					
15 Jun 05:50:35	56	KILL	Viper		*05:51:42	KILL	-	411	-	
15 Jun 05:50:57	176	NM	H W		05:52:04	N/M	-	HQ2	-	
15 Jun 05:51:56	37	NM	DRAGON/Spandrel BRDM		05:53:03	N/M	-	231	-	
15 Jun 05:52:04	37	NM	DRAGON/Spandrel BRDM		05:53:11	N/M	-	231	-	
15 Jun 05:52:21	37	NM	Sagger BMP		05:53:20	N/M	-	231	-	
15 Jun 05:52:21	37	NM	DRAGON/Spandrel BRDM		05:53:27	N/M	-	231	-	
					05:53:28	N/M	-	231	-	
					05:53:28	N/M	-	231	-	
15 Jun 05:52:26	139	NM	H W		05:53:33	N/M	150	B32	73 MM	0.538
					05:53:44	N/M	-	231	-	
					05:53:44	N/M	-	231	-	
15 Jun 05:52:43	139	KILL	125MM T72		*05:53:50	KILL	-	B32	-	
15 Jun 05:53:06	56	NM	H W		05:54:14	N/M	-	410	-	
15 Jun 05:54:31	167	NM	H W	S	05:55:39	N/M	-	D13	-	
15 Jun 05:54:32	192	NM	H W		05:55:39	N/M	D15	C36	125 MM	0.300
15 Jun 05:54:49	59	NM	H W		05:55:56	N/M	-	415	-	
					*05:55:58	KILL	-	450	-	
15 Jun 05:55:13	59	NM	L W		05:56:21	N/M	-	415	-	
15 Jun 05:55:15	59	NM	L W		05:56:23	N/M	-	415	-	

15 Jun 05:55:16	182	KILL	125MM T72	*05:56:23	KILL	D13	B26	125 MM	0.775
15 Jun 05:55:16	59	NM	L W	05:56:24	N/M	-	415	-	
15 Jun 05:55:28	59	NM	L W	05:56:36	N/M	-	415	-	
15 Jun 05:55:35	176	KILL	M60A1/A3, M48A5	*05:56:42	KILL	32C	HQ2	105 MM	1.013
15 Jun 05:55:44	138	NM	H W S	(Excessive Delay = 33 Seconds)					
15 Jun 05:55:44	59	NM	L W	05:56:52	N/M	-	415	-	
15 Jun 05:55:52	59	NM	L W	05:57:00	N/M	-	415	-	
15 Jun 05:55:56	59	NM	L W	05:57:04	N/M	-	415	-	
15 Jun 05:56:09	213	NM	H W S	05:57:16	N/M	-	D34	-	
15 Jun 05:56:11	213	NM	H W	05:57:19	N/M	-	D34	-	
15 Jun 05:56:14	213	KILL	Controller Gun	*					
15 Jun 05:56:30	37	NM	DRAGON/Spandrel BRDM	05:57:37	N/M	-	231	-	
				05:57:49	N/M	-	231	-	
				05:57:53	N/M	-	231	-	
15 Jun 05:56:38	8	NM	Sagger BMP	05:58:02	N/M	-	HQ3	-	
15 Jun 05:56:42	37	NM	TOW /AT6/HIND	05:58:06	N/M	-	231	-	
15 Jun 05:56:53	90	NM	TOW /AT6/HIND	05:58:17	N/M	-	A23	-	
				*05:58:19	KILL	-	B34	-	
15 Jun 05:57:31	41	KILL	Viper	*05:58:38	KILL	-	250	-	
15 Jun 05:57:25	27	NM	TOW /AT6/HIND	05:58:49	N/M	-	211	-	
15 Jun 05:57:27	90	NM	TOW /AT6/HIND	05:58:50	N/M	-	A23	-	
15 Jun 05:57:36	27	NM	DRAGON/Spandrel BRDM	05:58:59	N/M	-	211	-	
15 Jun 05:57:59	153	NM	H W						
15 Jun 05:58:00	153	NM	H W S						
15 Jun 05:58:02	153	NM	L W						
15 Jun 05:58:03	153	NM	H W						
15 Jun 05:58:04	153	NM	L W						
15 Jun 05:58:13	8	NM	H W	05:59:20	N/M	-	HQ3	-	
15 Jun 05:58:18	169	NM	H W S	05:59:25	N/M	-	D26	-	
15 Jun 05:58:22	153	NM	L W S						
15 Jun 05:58:23	153	NM	H W						
15 Jun 05:58:24	153	NM	L W						
15 Jun 05:58:25	153	NM	H W S						
15 Jun 05:58:28	153	NM	L W						
15 Jun 05:58:29	153	NM	L W S						
15 Jun 05:58:30	153	NM	H W S						
15 Jun 05:58:32	153	NM	H W						
15 Jun 05:58:33	153	NM	L W						
15 Jun 05:58:34	153	NM	L W						
15 Jun 05:58:38	59	NM	L W S	05:59:45	N/M	-	415	-	
				05:59:48	N/M	-	231	-	
15 Jun 05:58:40	[illegible]	NM	L W	05:59:48	N/M	-	HQ3	-	

* - An entry also exists in the NTCDRS Player Change Table

Rotation 8510, Segment 12 Pairing Correlation

------ R D M S			L o g ------			N T C D R S	P A I R I N G		T a b l e		
Date	Time	LPN	Result			Time	Result	Fir	Tar	Weapon	Range
9 Jun	05:00:19	102	HIT	M2, M85 MG		05:00:28	HIT	-	E44	-	-
9 Jun	05:00:34	102	HIT	M2, M85 MG		05:00:42	HIT	-	E44	-	-
9 Jun	05:00:32	102	HIT	M2, M85 MG		05:00:43	HIT	-	E44	-	-
						05:00:44	N-M	-	E44	-	-
9 Jun	05:00:57	149	N-M	light		05:01:07	N-M	-	11D	-	-
9 Jun	05:00:43	51	N-M	Sagger - BMP		05:01:15	N-M	-	415	-	-
9 Jun	05:01:00	51	HIT	M2, M85 MG		05:01:17	HIT	-	415	-	-
9 Jun	05:02:30	50	N-M	Sagger - BMP		05:02:56	N-M	-	414	-	-
9 Jun	05:03:52	149	N-M	light		05:04:02	N-M	-	11D	-	-
9 Jun	05:03:29	151	N-M	Dragon/Spandrel		(Excessive Delay = 27 seconds)					
9 Jun	05:04:57	149	N-M	light		05:05:07	N-M	-	11D	-	-
						05:05:24	N-M	-	135	-	-
9 Jun	05:05:38	149	N-M	heavy		05:05:48	N-M	-	11D	-	-
9 Jun	05:05:53	149	N-M	light		05:06:03	N-M	-	11D	-	-
9 Jun	05:06:37	50	N-M	Dragon/Spandrel		05:07:03	N-M	-	414	-	-
9 Jun	05:07:52	124	KILL	TOW/AT-6/HIND	*	05:08:11	KILL	-	ST3	-	-
9 Jun	05:08:00	67	KILL	M60A1/A3, M48A5	*	05:08:09	KILL	A13	A33	105 MM	0.200
9 Jun	05:08:00	67	HIT	M60A1/A3, M48A5		(Duplicate with KILL)					
9 Jun	05:08:41	146	N-M	heavy		05:08:51	N-M	-	33A	-	-
9 Jun	05:08:42	146	N-M	light		05:08:52	N-M	-	33A	-	-
9 Jun	05:09:10	149	N-M	light		05:09:19	N-M	-	11D	-	-
9 Jun	05:09:21	149	N-M	light		05:09:31	N-M	-	11D	-	-
9 Jun	05:09:27	51	N-M	TOW/AT-6/HIND		05:09:53	N-M	-	415	-	-
9 Jun	05:09:49	171	HIT	M60A1/A3, M48A5		05:09:59	HIT	H65	316	105 MM	1.488
9 Jun	05:10:11	51	N-M	Dragon/Spandrel		05:10:36	N-M	-	415	-	-
						05:10:45	HIT	-	D16	-	-
9 Jun	05:10:46	195	HIT	M2, M85 MG		05:10:55	HIT	-	350	-	-
9 Jun	05:10:51	171	HIT	M60A1/A3, M48A5		(Duplicate with KILL)					
9 Jun	05:10:51	171	KILL	M60A1/A3, M48A5	*	05:11:00	KILL	H65	316	105 MM	1.313
9 Jun	05:12:22	128	N-M	heavy		05:12:32	N-M	-	A21	-	-
9 Jun	05:12:25	128	N-M	heavy spare		05:12:33	N-M	-	A21	-	-
9 Jun	05:12:24	128	N-M	heavy		05:12:34	N-M	-	A21	-	-
9 Jun	05:12:27	128	N-M	heavy		05:12:36	N-M	-	A21	-	-
9 Jun	05:14:26	151	KILL	Dragon/Spandrel	*	05:14:41	KILL	-	21D	-	-
9 Jun	05:14:45	145	N-M	light		05:14:54	N-M	-	36A	-	-
9 Jun	05:14:44	145	N-M	heavy		05:14:55	N-M	-	36A	-	-
9 Jun	05:16:31	14	KILL	125MM T72	*	05:16:40	KILL	-	116	-	-
9 Jun	05:16:41	4	KILL	Dragon/Spandrel	*	05:16:57	KILL	-	66A	-	-
9 Jun	05:17:07	108	HIT	M60A1/A3, M48A5		(Duplicate with KILL)					
9 Jun	05:17:07	108	KILL	M60A1/A3, M48A5	*	05:17:16	KILL	-	D36	-	-
9 Jun	05:18:30	23	N-M	Dragon/Spandrel		05:18:56	N-M	-	135	-	-
						05:18:57	N-M	-	414	-	-
						05:19:04	N-M	-	230	-	-
9 Jun	05:18:26	25	N-M	light		(Excessive Delay = 26 seconds)					
9 Jun	05:19:03	78	HIT	M60A1/A3, M48A5		05:19:13	HIT	A13	D14	105 MM	0.500
9 Jun	05:14:34	132	KILL	30MM HIND/Vulcan		(Excessive Delay = 4:51)					
9 Jun	05:20:06	25	KILL	Controller Gun	*	05:20:14	150	CONT GUN KILL (Player Change Table)			
9 Jun	05:20:15	149	N-M	heavy		05:20:24	N-M	-	11D	-	-
9 Jun	05:20:50	149	N-M	heavy		05:20:59	N-M	-	11D	-	-
9 Jun	05:20:57	113	HIT	M60A1/A3, M48A5		05:21:06	HIT	B14	B33	105 MM	2.200
						05:21:13	HIT	-	642	-	-
9 Jun	05:21:26	113	KILL	M60A1/A3, M48A5	*	05:21:35	KILL	B14	B33	105 MM	2.050
9 Jun	05:21:33	149	N-M	heavy		05:21:42	N-M	-	11D	-	-
9 Jun	05:21:31	152	N-M	light		05:21:43	N-M	-	22D	-	-
9 Jun	05:21:48	149	N-M	heavy		05:21:58	FRAT	B14	11D	105 MM	0.763
9 Jun	05:21:49	89	N-M	heavy		05:21:58	N-M	-	B36	-	-

9 Jun	05:22:03	57	N-M	heavy spare		05:22:12	N-M	–	610	–	–
9 Jun	05:21:57	174	N-M	TOW/AT-6/HIND		05:22:23	N-M	–	B35	–	–
9 Jun	05:22:04	57	N-M	light		05:22:14	N-M	–	610	–	–
9 Jun	05:22:06	200	KILL	M60A1/A3, M48A5	*	05:22:16	KILL	B14	331	105 MM	1.788
9 Jun	05:22:15	57	KILL	Controller Gun	*	05:22:19	65D	CONT GUN KILL (Player Change Table)			
9 Jun	05:22:00	148	KILL	Controller Gun	*	05:22:23	610	CONT GUN KILL (Player Change Table)			
9 Jun	05:21:58	148	N-M	heavy spare		05:22:19	N-M	–	65D	–	–
9 Jun	05:21:58	148	N-M	Viper		05:22:20	N-M	–	65D	–	–
9 Jun	05:22:26	125	N-M	light		05:22:35	N-M	–	FD2	–	–
						05:22:58	N-M	–	E44	–	–
9 Jun	05:23:02	125	N-M	light		05:23:11	N-M	–	FD2	–	–
9 Jun	05:23:06	125	N-M	light		05:23:16	N-M	–	FD2	–	–
9 Jun	05:23:14	125	N-M	light		05:23:23	N-M	–	FD2	–	–
9 Jun	05:23:22	73	KILL	Controller Gun	*	05:23:30	A22	CONT GUN KILL (Player Change Table)			
9 Jun	05:23:39	59	HIT	M60A1/A3, M48A5		05:23:49	HIT	–	642	–	–
9 Jun	05:23:52	75	N-M	heavy		05:24:02	N-M	H65	B34	105 MM	0.388
9 Jun	05:23:56	75	HIT	M60A1/A3, M48A5		05:24:05	HIT	–	B34	–	–
9 Jun	05:23:56	75	HIT	M60A1/A3, M48A5		(Duplicate with KILL)					
9 Jun	05:23:56	75	KILL	M60A1/A3, M48A5	*	05:24:05	KILL	B14	B34	105 MM	0.888
9 Jun	05:24:07	151	HIT	M60A1/A3, M48A5		05:24:17	HIT	–	311	–	–
9 Jun	05:24:15	195	N-M	heavy		05:24:24	N-M	H65	350	105 MM	1.988
9 Jun	05:24:22	197	HIT	M60A1/A3, M48A5		(Duplicate with KILL)					
9 Jun	05:24:22	197	KILL	M60A1/A3, M48A5	*	05:24:31	KILL	B14	330	105 MM	1.063
						05:24:36	HIT	–	642	–	–
9 Jun	05:24:45	72	N-M	heavy		05:24:54	N-M	H65	B16	105 MM	1.838
9 Jun	05:24:56	125	N-M	light		05:25:05	N-M	–	FD2	–	–
9 Jun	05:24:57	72	N-M	heavy		05:25:06	N-M	H65	B16	105 MM	1.775
9 Jun	05:25:04	152	N-M	heavy		05:25:14	FRAT	H65	22D	105 MM	0.613
9 Jun	05:25:08	125	N-M	light spare		05:25:17	N-M	–	FD2	–	–
9 Jun	05:25:11	152	N-M	light		05:25:21	N-M	–	22D	–	–
9 Jun	05:25:12	152	N-M	light		05:25:22	N-M	–	22D	–	–
9 Jun	05:25:14	152	N-M	light		05:25:23	N-M	–	22D	–	–
9 Jun	05:25:15	152	N-M	light		05:25:24	N-M	–	22D	–	–
9 Jun	05:25:37	152	KILL	Dragon/Spandrel	*	05:25:52	KILL	–	22D	–	–
9 Jun	05:24:15	195	N-M	heavy		05:26:16	N-M	H65	350	105 MM	1.588
9 Jun	05:26:07	195	N-M	heavy		(Duplicate with KILL)					
9 Jun	05:26:13	195	KILL	M60A1/A3, M48A5	*	05:26:22	KILL	H65	350	105 MM	1.588
9 Jun	05:26:13	130	N-M	heavy spare		05:26:22	N-M	–	A24	–	–
9 Jun	05:26:32	151	N-M	heavy		05:26:41	N-M	H65	311	105 MM	1.400
9 Jun	05:27:55	50	N-M	TOW/AT-6/HIND		05:28:21	N-M	–	414	–	–
9 Jun	05:28:15	87	HIT	M60A1/A3, M48A5		05:28:24	HIT	B14	B14	105 MM	1.388
9 Jun	05:28:28	167	N-M	heavy		05:28:37	N-M	B14	312	105 MM	1.400
9 Jun	05:29:33	119	N-M	heavy		05:29:42	N-M	–	H65	–	–
9 Jun	05:29:45	119	N-M	heavy		05:30:03	N-M	–	H65	–	–
9 Jun	05:30:43	119	N-M	heavy		05:30:52	N-M	–	H65	–	–

* - An entry also exists in the NTCDRS Player Change Table